The Retirement Income System in Canada: Problems and Alternative Policies for Reform

Volume II
Appendices

Task Force on Retirement Income Policy
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The Retirement Income System in Canada: Problems and Alternative Policies for Reform

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FOREWORD

This volume contains 20 appendices to The Retirement Income System in Canada: Problems and Alternative Policies for Reform, the report of the Task Force on Retirement Income Policy to the Government of Canada. Many of the appendices are technical papers, the results of which are used in the main report; others explore the various assumptions used in the report or elaborate on points made in it; some of the appendices are purely descriptive.

All of the appendices bear the names of those principally involved in their preparation. In many cases agreed modifications to the appendices were made after discussions within the Task Force. Those wishing more information on any of the appendices should contact the authors directly.

THE RETIREMENT INCOME SYSTEM IN CANADA: PROBLEMS AND ALTERNATIVE POLICIES FOR REFORM

VOLUME II

LIST OF APPENDICES

APPENDIX 1

THE DEVELOPMENT OF THE RETIREMENT INCOME SYSTEM IN CANADA

Hart D. Clark*

A. Provisions for Old Age Prior to 1900

In Canada at the beginning of the 19th century, such provisions as were made for old age could hardly be called a 'retirement income system'. It is very doubtful, indeed, if any person thought of such a system being developed in the future, influenced as they were by the living conditions of the average family in the rural society of that era. These conditions were such that many hard-working families found that they could barely make enough for current needs, let alone try to set aside something for old age.

The norm for Canadian society, until at least the end of that century, was for people to work as long as possible. Then, when those who had survived were no longer able to provide for themselves, their families were expected to support them. Failing that, the aged poor had to fall back on such charity as was provided through religious orders, mainly in Quebec, local authorities, mainly in the rest of Canada, or private charity. As late as the beginning of this century, it was generally accepted that those who failed to save enough and were not supported by their families deserved the destitution that was their lot. The thought of levying taxes on the workers in order to provide assistance to others who had failed to provide for themselves was simply unacceptable.

Although this social philosophy dominated at the turn of the century, events were already well advanced which would gradually undermine it. Throughout the 19th century, major changes had been taking place in the working and living habits of the population. Younger workers were moving from the more self-contained rural family units to the many new industries being established in cities and towns and to new centres of natural resource development. The requirements for increased mechanical efficiency by employees meant that the work performed by independent craftsmen diminished in importance. As a result, those new urban workers, who formerly would have continued at their independent crafts as long as they were able to work, now were automatically retired at a specified age - usually 70. Thus the process of industrialization set the stage for the gradual development of our retirement income system.

B. Legislation Concerning the Retirement Income of Canadians

1. Early Interest in Old Age Pensions. During the first half century of Confederation, there was more interest among the general public and members of Parliament in the possibility of establishing a national old age pension plan than any other alternative means of providing Canadians

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with greater retirement income. In no small measure, this interest was prompted by developments abroad. In 1889, Germany introduced a contributory plan for all wage earners and lower-paid salaried employees. Denmark established a means-tested plan in 1891, as did New Zealand in 1898, followed by the Australian states of New South Wales and Victoria in 1901. In 1908, those Australian state plans were superseded by a Commonwealth of Australia plan. In the same year a limited plan was introduced in the United Kingdom - the object of which, in the words of Lloyd George, then Chancellor of the Exchequer, was to exclude "wastrels and loafers" and confine the resources of the state to providing for "undeserved poverty". Not surprisingly, there was strong pressure in Canada also for the introduction of a pension scheme, but only for "the aged and deserving poor". Proposals were made in the 1906 and 1907 sessions of Parliament and in 1908 a Committee of the House of Commons was set up "to investigate the subject of old age pensions". However, other developments served to delay the introduction of the first plan of this type for almost 20 years.

2. <u>The Government Annuities Act</u>. One of the developments that played an important part in forestalling the establishment of a national pension plan was a report in 1886 of a Royal Commission that had been appointed to study labour problems in Canadian industry, including the problem of those who had become too old to work. The Commission recommended the creation of a system of government annuities modelled along the lines of one already operating in France.(1) It was not until the 1907 session of Parliament, however, that specific proposals were put forward for consideration.

The Government Annuities Act was approved by Parliament during the following session. The stated purpose of the legislation was to "authorize the sale of government annuities, to the end that habits of thrift be promoted, and that thereby opportunity be given to the people of Canada to provide for old age by means of annuities ..." The Act reflected a continuing concern that those who worked hard could find themselves no better off at the end of their working years than "wastrels and loafers". Following enactment of the legislation, consideration of the desirability of establishing a national old age pension plan by the special parliamentary committee created for that purpose was discontinued. In fact, when the Minister of Finance put forward the Annuities Bill in 1908, he justified the government-subsidized program on the grounds that it served to eliminate the need for the state to establish such an old age pension plan. Government subsidies under the annuities program were to be limited to paying interest at a slightly higher rate than would otherwise have been available (4% in 1908 when the current rate of Dominion of Canada Bonds was approximately 3 3/4%), and to absorbing the costs of selling and administration. Even with these subsidies and the introduction of a government policy to promote the sale of government annuities as an alternative to bonds for a time in the early 1920s, the results did not come up to expectations. By 1928, fewer than 9,000

(1)A government annuities system had been operating in Britain also since about 1810.

individual contracts and certificates had been issued. No doubt these disappointing results were a factor in the recurring pressures that developed for the establishment of an old age pension plan. As outlined more fully later, these pressures culminated in the adoption by Parliament in 1927 of the Old Age Pensions Act.

During the depression years, when bond rates dropped to well below 4%, the continuing availability of the 4% interest rate and out-of-date mortality tables provided a bargain for purchasers of government annuities. Consequently, by March 31, 1938, the total number of individual contracts and certificates issued had jumped to over 42,000. However, the most popular years of the program came after it began to offer group annuity contracts in 1938. Even though the mortality tables were brought into line with current mortality rates, the continuing advantage of the 4% interest rate and subsidized administration costs resulted in these contracts - which provided annual maximum benefits of $1,200 - being the foundation on which hundreds of private plans were built. In 1948, however, the interest rate on new contracts was reduced to 3% and mortality tables were again updated in order to reduce the degree of government subsidy. As a result, the premium rates of government annuities, while still competitive with those of private companies, no longer were bargains.

Over the following 15 years, interest rates generally increased and premium rates consequently were reduced. But the premium rates on government annuities fell more slowly than those of private companies, with the result that they were no longer competitive. After carefully reviewing the possibility of using annuities again as a source of borrowing, the government accepted the recommendation of the Glassco Commission that the program was no longer required as an "encouragement of thrift". The active promotion of the sale of these annuities was ended in 1968. In December of 1975, legislation cut off the right to enter into new contracts. Even so, it may well be another 50 years before the last annuity payment is made under that Act.

3. <u>The Income Tax Act</u>. One of the most important items of federal legislation which influenced the growth of private pension plans was the Income War Tax Act, which was enacted in 1917. The first reference to pension plans appeared in amendments to the Act two years later. It allowed an employee to deduct from income the amount of contributions to a pension fund or plan which were deducted by his employer from his remuneration. It also provided that pensions paid from such funds or plans were taxable. The law was silent as to employers' contributions, but apparently these were felt to qualify as a deductible business expense.

It was not until 1936 that a ceiling was established on the annual amount of an employee's pension contributions that could be deducted from taxable income - initially $300.(2) In 1941, a further

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(2)Using the annual Consumer Price Indices (CPIs) for 1936 and 1978, this $300 would be the approximate equivalent of $1,480 in 1978. Using average wages and salaries (AWS) as the measure, the $300 was 33.2% of the estimated AWS in 1936 while the $3,500 ceiling in 1978 was 25.4% of that year's AWS.

amendment was introduced to cover employer contributions as a result of doubts that had arisen as to whether they properly qualified as a business expense. The amendment permitted an employer to deduct the payment to a pension fund on behalf of each employee of up to $300 annually, providing that the total did not exceed 5% of annual payroll costs.

In 1942, the right to deduct either employee or employer contributions was restricted to plans approved by the Minister of National Revenue because deductions were being claimed for funds which were not being used for genuine pension purposes. High wartime tax rates had given employers a strong incentive to stretch the meaning of a pension plan to support their claims for higher deductions.

In 1944, the Income Tax Act was amended to allow an additional deduction of $300 per year under any plan in respect of contributions for past services by an employee who had not previously contributed during that period.

In line with the recommendations of the Royal Commission on the Taxation of Annuities and Family Corporations (the Ives Commission), the Act was amended in 1945 to raise the ceilings on tax deductible employee contributions to $900 per annum for current service and a second $900 for past service while not a contributor. The maximum amount deductible as an employer's contribution was increased to $900 per employee. The requirement that the employer's deduction in respect of all employees not exceed 5% of payroll was repealed.(3)

A further amendment in 1945 made the tax relief for pension plan contributions and the tax exempt status of pension funds conditional upon the continuing approval of the plan by the Minister of National Revenue. In 1947, that Minister published rules and related guidelines under which a pension plan would qualify for this tax relief. The Minister had to be sure that each plan was genuine and that corporations did not evade taxes on their earnings by putting large and unnecessary sums into pension funds. The guidelines also attempted to influence pension plan design in such matters as non-discrimination, coverage, vested rights of terminating members, and the quality of investments. The vesting requirements led to the amendment of many of the older plans to provide deferred annuities to employees whose services terminated before the normal pensionable age in their plans and who previously received nothing but returns of contributions.

No further major tax changes were adopted until 1954, when the annual deduction ceiling of $900 was raised to $1,500. In 1958, the deduction for employee contributions for services prior to becoming a

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(3)Using the average CPIs for 1945 and 1978, this $900 would be the approximate equivalent of $3,625 in 1978. Using AWS as the measure, the $900 was 55.4% of the estimated AWS in 1945 while the new $3,500 ceiling was 29.5% of AWS in 1976 and 25.4% in 1978.

member of his then current pension plan was broadened. Thereafter, in a taxation year, an employee could deduct an amount to enrich benefits earned in respect of past services while he was a contributor equal to the difference between $1,500 and his current service contributions in the taxation year. Initially this was subject to the proviso that he claim no other contributions for past services in that taxation year but that restriction was subsequently dropped. The $1,500 ceiling was raised to $2,500 for the 1972 taxation year and to $3,500 for the 1976 taxation year.(4)

Meanwhile, in 1957, an important amendment to the Income Tax Act authorized the creation of Registered Retirement Savings Plans (RRSPs). These were designed to assist not only the self-employed in providing for their old age security, but also the employees who were not members of pension plans or who wished to supplement the pensions which their plans provided.

During those years, other developments in the control of pension plans were taking place. The federal government's efforts to influence pension plan design in the 1940s had led to increasing objections on two grounds. Firstly, it was argued that it was not proper for the Income Tax Act to be used to carry out measures of social policy that had little connection with tax revenues and, secondly, that since most private pension plans were subject to provincial jurisdiction, the federal government should not be attempting to exert that influence on pension plan design.

The federal government recognized the validity of these objections. It decided to narrow its regulatory controls to matters relating to the level of benefits, the methods of funding, and others affecting the level of contributions under pension plans before the Minister of National Revenue would approve a plan as being eligible for the tax deductions permitted under the legislation. Consequently, since the mid-1950s there has been a gradual withdrawal of a number of these rules relating primarily to social policy.

In recent years a number of other provisions to assist persons in receipt of retirement income have been added to the Income Tax Act and its administrative rules. The more important of these are:

- the indexing of the age exemption for taxpayers 65 years of age and over. It was $1,520 in 1978;

- all pension income up to a maximum of $1,000 is deductible;

- the amount of interest income from Canadian securities and certain taxable dividends from Canadian corporations up to a maximum of $1,000 is deductible;

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(4)Using the average CPI for 1954, 1972 and 1978, the $1,500 limit of 1954 would be the approximate equivalent of $3,898 in 1978 while the $2,500 limit of 1972 would be the approximate equivalent of $4,179 in 1978. If average wages and salaries were the measure, the $1,500 in 1954, $2,500 in 1972, and the $3,500 in 1976 and 1978 were 47.3%, 32.2%, 29.5% and 25.4% of AWS in those years, respectively.

- deductibility of employer contributions to prefund, within certain limits, the adjustment of pensions after retirement on the basis of anticipated long-term future increases in the Consumer Price Index (CPI); and

- the 1978 budget provisions which widened the options to permit the purchase of an annuity payable up to age 90 under a Registered Retirement Savings Plan as an alternative to a life annuity, commencing no later than age 71.

4. Federal and Provincial Pension Benefits Acts. The withdrawal of the rules of a social policy nature from the income tax guidelines for pension plan approval, mentioned above, has been followed since 1965 by a gradual introduction of other rules under pension benefits legislation. They now apply in six provinces - Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan and Alberta. The federal Pension Benefits Standards Act applies in respect of employment under federal jurisdiction, including all employment in the Northwest and the Yukon Territories.

These Acts have several objectives. One is to ensure that sufficient funds are set aside to provide the benefits that employees are promised in accordance with the terms of their plans. A second is to establish safeguards for funds against the risks of speculative investments, lack of diversification and, particularly, excessive investments in the securities of the employer-corporation.

In addition, these Acts are intended to ensure a greater degree of portability of pensions. Upon termination of employment before normal retirement, a large proportion of employees had been retaining either no right to earned pension benefits or only very meagre entitlements. In an effort to improve this situation, these Acts introduced the general requirement that an employee who ceased to be employed after attaining age 45 and completion of 10 years of service, or of 10 years of participation in the plan, should be entitled to a deferred pension benefit.

5. Other Federal and Provincial Legislation Affecting Retirement Income.

a) Workmen's Compensation. One component of retirement income is provided almost entirely through the operation of provincial laws for the benefit of employees who suffer injuries or death in the course of employment. Originally it was under the common law that employers in Canada were held liable for damages for such injuries, but only if the employer was found to be negligent. So few cases were settled to the advantage of the injured employees or their dependants that a series of provincial laws was enacted over the years, commencing in 1886. These gave an increasing degree of protection to employees, with a gradual trend to a new 'no fault' system which started with legislation in Quebec in 1909. Federal acts have provided equivalent protection since 1915 for employees of the federal government and its agencies and, since 1945, for merchant seamen not otherwise covered. Members of the Canadian Forces and the R.C.M.P. have had comparable protection under the Pension Act and earlier

legislation which antedated Confederation. Permanent disability and surviving spouse's pensions payable under all of these acts continue after what would have been the normal retirement ages of the injured employees and thus form an important element of their retirement income.

b) Old Age Pensions (OAP), Old Age Security (OAS) and the Canada/Quebec Pension Plans (C/QPP). It will be recalled that, following the passage of the Government Annuities Act in 1908, the issue of introducing an old age pension plan was temporarily sidetracked. The pension issue was next placed before the House of Commons in 1911 and again in 1912-1913. While active consideration was delayed during World War I, pressures began to build up again once the war was over, leading to the passage of the federal Old Age Pensions Act in 1927.

Initially that Act provided that the federal government would reimburse provincial governments for 50% of the cost of pensions of up to $20 a month paid by the provinces on a means-tested basis to persons aged 70 and over who, among other qualifications, had resided in Canada for 20 years or more. The federal share was increased to 75% in 1931. The application of this plan did not become national in scope until the last two remaining provinces - Quebec and New Brunswick - joined in 1936 and 1937 respectively. As a result of war and post-war inflation, the level was increased to $25 in 1943, to $30 in 1947, and to $40 in 1949, along with various changes in the other conditions under which benefits were paid over the years.(5) On January 1, 1952, this means-tested plan was replaced by the universal Old Age Security Act under which the federal government paid pensions of $40 a month at age 70, subject only to a residence test. Means-tested pensions were introduced at the same time for those aged 65 to 69 under a new Old Age Assistance Act. They were subject to a $40 monthly maximum, with the federal share of the cost being 50%.

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(5)Using the annual CPI and AWS (estimated in the cases of 1927 and 1943) in these years as measures of comparison, the following table shows the relationships between the Old Age Pension levels from 1927 to 1949 and the Old Age Security levels from 1957 to 1963, on the one hand, and the average OAS pension in 1978 on the other.

	OAP				OAS				
	1927	1943	1947	1949	1957		1962	1963	1978
A.-	$20	$ 25	$ 30	$ 40	$ 46	$ 55	$ 65	$ 75	$159
B.-	81	102	107	121	114	136	150	170	159
C.-	22.2%	20.2%	19.0%	21.4%	15.6%	18.7%	18.6%	20.8%	13.8%

A - Actual OAP or OAS
B - 1978 Equivalent of A using the CPI
C - A expressed as % of AWS

During the next 15 years, increases were made in the monthly Old Age Security pension from $40 to $46 in July 1957, $55 in November 1957, $65 in February 1962 and $75 in October 1963. Corresponding increases were made in the maximum means-tested pension under the Old Age Assistance Act.

In 1958-1959, an exhaustive report entitled Economic Security for the Aged in the United States and Canada was prepared for the Government by Dr. Robert M. Clark of the University of British Columbia. Its purpose was to examine the problems connected with the introduction of a national contributory program in Canada with graduated benefits, as distinct from the flat rate benefits paid under the Old Age Security Act. The report ended without recommendation as to whether or not such a plan should be instituted. While a great deal of technical work on a contributory plan was done within the federal government, nothing tangible occurred before the change of administration after the general election of 1963. The new government elected in that year had included the introduction of the Canada Pension Plan as one of the major planks in its election platform.

The Canada Pension Plan came into force on January 1, 1966, along with its counterpart, the Quebec Pension Plan. At the same time, provision was made for an annual reduction in the eligible age for Old Age Security from age 70 to age 65 and the consequent gradual elimination of the Old Age Assistance Act. In 1966, the Old Age Security Act was amended to provide the monthly Guaranteed Income Supplement, known as GIS. In the same year the Canada Assistance Plan (CAP) was enacted to encourage "the further development and extension of assistance and welfare service programs throughout Canada by sharing more fully with the provinces in the cost thereof". It provided, among other things, for the replacement of the assistance payments under the Old Age Assistance Act by payments under the new Act, under agreements on a province by province basis. Apart from these measures, some provinces provide supplementary assistance to their residents who are in need, geared to either an income test or a needs test.

The Canada Pension Plan was noteworthy, among other things, for its provision of post-retirement pension increases related to the CPI, subject to a maximum increase of 2% per year. Between 1968 and 1970, OAS benefits were also indexed in the same way as those under the Canada Pension Plan. A number of changes were subsequently made in an effort to develop a more satisfactory method of relating benefit payments to inflation prior to adoption in October 1973 of the existing system under which OAS benefits are escalated quarterly in line with the full rate of increase in the CPI. In January 1974, the 2% ceiling on indexing under the C/QPP was eliminated, but indexing remains annual.

These, then, are the main portions of federal-provincial legislation which, as amended from time to time, are directed primarily towards the provision of the retirement income of older Canadians beyond what may be available from their own savings.

6. Other Measures. There are other components of the social security system which, directly or indirectly, assist the incomes of retired Canadians, although not directed primarily to them. Most of these have developed since the depression of the 1930s, which had exposed so dramatically the inadequacies of the voluntary and public programs then in existence, due in part to the limited financial resources of some provinces.

Recognition of these inadequacies led to persistent demands for a nationwide social security system. Such a system became possible only after amendments were made to the British North America Act with the agreement of the provinces. These gave the federal government authority in specific areas which allowed Parliament to pass the Unemployment Insurance Act in 1940 and the Old Age Security Act in 1951.

Two other programs which have been introduced as part of the national system are the national hospital and medical care insurance plans, the costs of which are shared by the federal and provincial governments. These are of importance to Canadians of all ages, but particularly to the elderly, whose savings in earlier times had so often been wiped out by high hospital and medical bills.(6)

C. Development of Employer-Sponsored Pension Plans

1. The First Impetus for Pension Plan Development. The requirement for automatic retirement that accompanied the industrialization and urbanization of the economy, as mentioned earlier, created a problem for the new urban workers of 100 years ago. Frequently they could not afford to remain in their urban homes with no families nearby to which they or their survivors could turn for support.

At first no formal arrangements for their retirement income were made. Employees of some of the larger private employers grouped together to form pension fund societies to provide a degree of mutual protection for themselves and their families at the time of retirement or death. Some employers, such as the Hudson's Bay Company, continued to pay retirement gratuities as they had been doing for well over a hundred years. The legislatures of the pre-Confederation provinces continued to grant pensions to former government employees or to their widows on an ad hoc basis. Undoubtedly a few employers kept up salary payments to those old employees who had given long and faithful service but who could no longer put in a full day's work.

As time went on, an increasing number of other employers became concerned about the inhumanity of simply dismissing their old employees without adequate retirement income. In Canada, as in Britain where the industrialization and urbanization of the population as well as pension plan development occurred earlier, first the government and then the railway and financial companies took the lead in providing pension plans.

(6) The former commenced on July 1, 1958 with all of the country participating by January 1, 1961. Medicare commenced in 1968 and was operating across Canada by 1972.

2. Public Sector Pension Plans. The first statutory Canadian pension plan was introduced in 1870 by the new Government of Canada for certain of its permanent employees.(7) Quebec was the first province to provide a plan of this type when it was introduced in 1876. Ontario did not introduce its plan until 1920 - the same year in which the United States established its first plan for federal government employees.

It is interesting to note the main features of that first Canadian plan, the purpose of which was described in the following preamble to the 1870 Act: "Whereas, for better ensuring efficiency and economy in the Civil Service of Canada, it is expedient to provide for the retirement therefrom, on equitable terms, of persons who, from age or infirmity, cannot properly perform the duties assigned to them..." The Minister of Finance made it clear that the new Act was designed to get away from the old system of granting pensions without any legislated rules to guide the government. Superannuation allowances were to be granted to civil servants who had served at least ten years and attained the age of 60, or earlier if they were no longer able to perform their duties because of physical incapacity. There was no compulsory retirement age, but an employee to whom such an allowance was offered could not refuse to retire. There were no survivor benefits, although a resolution to provide them was debated in the House of Commons and defeated.

The allowance was calculated on the basis of 2% of the average salary over the last three years of service, multiplied by the number of years of service up to 35. Thus the 70% maximum which now applies in so many Canadian pension plans and the Income Tax Rules had its start in 1870. Prior service with the provinces which formed the new Dominion was recognized, as was up to ten years of service elsewhere in the case of certain specially qualified persons entering the Civil Service after the age of 40.

Contributions by employees were at the rate of 4% on annual salaries of $600 or more, while the rate was 2 1/2% on lower salaries. There was no current contribution by the government, reflecting the view expressed by the Minister of Finance of the day that those employee contributions would be adequate in the long run. The low contribution rates, which originally had been regarded as adequate, were reduced by one-half in 1873 due to initial excesses of contributions over benefits, but by 1893 the cost to the government of pensions-in-pay was increasing so rapidly that the employee contribution rates were raised so as to reduce the burden on the taxpayers.

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(7)This plan was developed after studying the provisions of the various superannuation schemes for British civil servants which were already in operation. In Britain, an Act of Parliament in 1810 was, among other things, the first to be concerned with the provision of pensions generally for those in public office. The first British Act devoted exclusively to Civil Service pensions was the Superannuation Act of 1834.

Then, in 1898, participation in the plan was closed to future members of the permanent civil service. Instead of the superannuation protection which those previously appointed continued to enjoy, a Retirement Fund was established into which the new members were required to contribute and from which they would receive on retirement only a return of their own contributions with interest. The closing of this first plan to new members led to the situation where the government continued to employ an increasing number of permanent employees into their 70s and 80s instead of forcing them to retire without a pension. This procedure was having such an effect on efficiency and salary costs that interim pension legislation was passed by Parliament in 1919 and 1920 to facilitate the immediate retirement of those who had been kept on too long. This was followed by the adoption in 1924 of a new Civil Service Superannuation Act for permanent employees. It continued the provisions of the original plan of 1870, as amended, for those still under it. This new Act was replaced by the present Public Service Superannuation Act in 1954, when it was broadened to include temporary employees.

3. Private Sector Pension Plans. The development of other pension plans in Canada was slow up to the end of the depression of the 1930s. While there was mention in Hansard in 1870 of a plan already in operation for employees of the Bank of Montreal, this was a pension fund society established by employees of the Bank under the authority of a special statute in 1860. What is reported as the first formal pension plan of a private employer was introduced in 1874 by the Grand Trunk Railway for its officers, supervisors and clerks. It was a contributory plan, with pensions based on length of service and the average salary over the best ten years.

In 1887, the Pension Fund Societies Act was passed to permit the establishment of pension fund societies for the benefit of employees of companies incorporated by Act of Parliament. That Act contemplated the possibility of contributions being made by a corporation to such a fund, as well as by employees. The Railway Act was amended in 1896 to validate certain resolutions already made by different railway companies concerning appointments and superannuation. This suggests that the Grand Trunk was not the only railway with a plan then in operation. The CPR plan was introduced in 1902. Apart from railway plans, seven others are known to have been introduced by commercial or industrial establishments by 1900, six of these being financial institutions while the seventh was a manufacturing company.

In addition to the plans of railway companies, only 59 industrial plans are known to have been introduced from 1900 to 1909, followed by another 172 in the next ten years.(8) Several of these were plans originally adopted by companies in the United States and extended to Canadian subsidiaries or affiliates, while a smaller number were introduced because of British affiliations. Up to this time pension funds were administered by or on behalf of the employers by trustees. While the Royal Trust Company has been a trustee of pension funds since 1915, trust companies generally are reported not to have sought pension busi-

(8)Dominion Bureau of Statistics "Survey of Pension and Welfare Plans in Industry, 1947" (Reference Paper No. 4, Table 13).

ness actively until the 1940s.(9) The employer had full discretion as to whether a fund would be established on a fully or partially funded basis or on a pay-as-you-go basis with the cost of pensions being financed after an employee retired.

The 1920s saw the life insurance companies starting to offer group annuity contracts under which they would guarantee the payment of pension benefits in accordance with the provisions of the pension plan in return for payment of the premiums specified in the contract. This approach was designed to relieve employers of the problems of trying to manage their pension funds and to give employees assurance that their pensions would be paid. The first such contract had been issued in the United States by the Metropolitan Life Insurance Company in 1921. The first group contract was issued in Canada by the Sun Life Assurance Company in 1923, but its second contract in Canada was not issued until 1928. The next Canadian companies reported in this field are the Confederation Life in 1929 and the Canada Life in 1931.(10) Under the economic conditions of the 1920s, Canadian employers apparently did not see much advantage in giving up their self-administered plans for the insured plans. Indeed, during those years, Canadian insurance companies introduced more group annuity contracts in Britain and the United States than in Canada.

As no regular basis for reporting on private pension plans was developed until the 1960s, it is difficult to obtain a complete picture of what happened in those earlier years. The first detailed study of Canadian pension plans appears to be that made by the Industrial Relations Section of Queen's University, which conducted a careful analysis of 120 industrial retirement plans as of April 1938.(11)

This study gives an interesting insight into the development of industrial pension plans in Canada up to that year. In the early part of the century, the majority of the newly established plans covered by that survey were non-contributory. From 1929 on there was a definite shift to contributory plans, apparently as a result both of increasing pension costs and of the financial position of the employers as business was affected by the onset of the depression. These problems of providing adequate financing in the early 1930s led to the first real swing from plans with pension funds administered by employers to the insured plans underwritten by insurance companies, which guaranteed the payment of pension benefits in accordance with the terms of the plan. The availability of insured plans meant that smaller employers, who had been reluctant to set up their own pension funds, started to provide plans for their employees. At the same time, there was a general strengthening of the contractual rights of the employees with an increasing tendency to look on retirement provisions as joint employer-employee savings plans, rather than as rewards for long service. The combination of these influences resulted in a clear trend in the direction of contributory insured plans, which was accentuated after 1934.

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(9)Society of Actuaries, Transactions, 1958. Vol. X, p. 176.
(10)Society of Actuaries, Transactions, 1958. Vol. X, p. 179.
(11)A survey was carried out under the auspices of the National Employment Commission in 1937, but it did not go into as great detail on features of historical interest as did later surveys.

Quite apart from its effect on the contributory and funding features of existing pension plans, the great depression of the 1930s emphasized the financial insecurity of older people, creating the awareness for their need of greater retirement income and, thus, became an important impetus for the great development of private employer pension plans in Canada over the next 25 years. During World War II, the combination of a number of other factors such as manpower shortage and wage controls (which did not apply to the cost of fringe benefits) provided employers with the incentive to introduce pension plans both as a recruiting device and to provide improved terms of employment for employees. Union bargaining and increased acceptance of the concept of pensions as deferred wages also had some influence.

The Queen's University study did not mention federal legislation, such as the Government Annuities Act and the Income Tax Act, as having influenced the growth of pension plans one way or another. Although the former Act had been in operation since 1908 and employers had been authorized to purchase annuities through individual contracts for their employees, few employers had done so. This was because of the requirement under those contracts for both the employer's and employee's contributions to be held for the ultimate benefit of the employee no matter when his service terminated. At that time, most employers felt quite strongly that an employee who had resigned to work for another employer did not deserve to receive any benefit from the first employer's contributions. It was only in 1938 that the government offered the group annuity contracts similar to those which insurance companies had been offering for 15 years.

Only four group government annuity contracts had been concluded by March 31, 1939. However, from then until 1948, these group contracts, using what had become a favourable combination of interest and mortality factors, offered annuities at rates considerably below the premiums charged by insurance companies and provided an incentive to the rapid growth of pension plans in those years. In 1948, the premium rates were sharply increased. Although the premiums were lowered from time to time over the next 20 years, they were, as a conscious matter of public policy, allowed to become less and less competitive with those offered by private enterprise to the point where government annuities were no longer an influence in the development of private pension plans.

Other legislation had a much more continuing influence and effect on that development. The Income Tax Act, as indicated previously, has been a major factor in pension plan design since the 1940s. Over these years, the Department of National Revenue has issued a series of Information Circulars setting out the provisions of that Act and the administrative rules that apply to the registration of employees' pension plans. The Old Age Security Act commenced in January 1952, with its $40 a month benefits paid to persons aged 70 who met the residence qualifications. It provided a most important retirement income base on which private pension plans could be built. In some private plans provisions were made so that the combined pension income would remain constant for life. Under this provision, the private plan benefit was paid at an initial higher monthly level which dropped by $40 at age 70. This type

of arrangement worked smoothly for the first five years but from 1957 on it became less prevalent. This was because of the lack of administrative simplicity as Old Age Security benefits started a series of increases from the original $40 level, followed in 1966 by the annual reduction in the age of OAS eligibility from 70 to 65.

Those private pension plans have been substantially affected also by the legislation enacted during the last 15 years as described earlier. First came the series of pension benefits Acts with their requirements on minimum solvency standards for those plans and on minimum standards for vesting of employer contributions in employees. Then followed the Canada and Quebec Pension Plans which resulted in the reduction of the contribution rates and consequential lowering of benefits in many of the private plans so as to keep their relative total pension costs in line with what they were before.

D. The Continuing Development of the Retirement Income System

It is evident from this brief account that the retirement income system in Canada has undergone a substantial evolution over the last two centuries. Much of that evolution has resulted from the transformation of the nation from a predominantly rural and agricultural society to one that is heavily urban and industrial. The changing nature of our society has, in turn, created new needs and new attitudes with respect to social security generally - and particularly with respect to the security of the elderly. Instead of being almost solely dependent on their family or, failing that, on such charity as might be available, older Canadians now have available as a matter of right a wide variety of provisions in cash and in kind to help support them in retirement.

Given the experience of years past, there is every reason to expect that the retirement income system will continue to evolve in response to the ongoing changes in Canadian society.

APPENDIX 2

A COMPARISON OF THE RETIREMENT INCOME SYSTEMS OF CANADA AND OTHER COUNTRIES

Hart D. Clark*

This appendix provides a comparison of the principal features of the Canadian retirement income system with those of a number of the more important industrialized countries, including France, West Germany, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States. The comparison is based on information drawn from several different sources, all of which are listed in the bibliography at the conclusion of the appendix. Where relevant, some references have also been made to the retirement income systems in several other countries in addition to those listed above; these references are based on worldwide surveys of more than 100 countries undertaken by the U.S. Department of Health, Education and Welfare in 1975 and 1977. A separate section dealing with tax arrangements is based on a survey of 17 countries undertaken by the Swiss Reinsurance Company of Zurich.

In Canada, and in each of the seven countries reviewed in some detail, the retirement income system consists of a public pension program, supplemented by employer-sponsored pension plans and private savings. The relative importance of these two components varies considerably from country to country. The paper describes the basic structure of the public component of the retirement income system in these countries, including the level of covered earnings, the proportion of pre-retirement earnings replaced by public pensions, the extent to which the real values of pensions-in-pay are preserved, the financing of earnings-related old age insurance plans, and retirement age. This is followed by a description of employer-sponsored pension systems in respect to such matters as coverage, methods of financing, portability and vesting, and pre- and post-retirement adjustment of pension values. The taxation arrangements for both public and private pension plans are then described and the levels of retirement income provided from the combination of public and private plans are subsequently compared. Finally, the position of the Canadian system relative to those of the seven major industrial countries is summarized.

A. Public Portion of the Retirement Income System

1. Pensions. Canada, together with six out of the seven other industrial nations, operates contributory old age insurance plans which are related to earnings and service. Eligibility for the standard rate of basic benefit in the Netherlands depends only on the length of insured

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* Task Force on Retirement Income Policy. Department of Finance.

status. The same qualification applies to the original flat rate benefit scheme in the United Kingdom, while the new supplementary public plan which was introduced in April 1978 is related to both earnings and service.

Out of the group of seven industrial countries, only Sweden maintains a universal plan providing flat rate benefits to all qualified citizens and an earnings-related program similar to the Old Age Security (OAS) program and the Canada Pension Plan (CPP) in this country. The 1977 U.S. survey referred to above indicates that Denmark, Finland, Mauritius and Norway are the only other countries which also have a similar combination of public pension programs. In addition, the survey indicated that more than 100 countries in that same year had some form of old age, survivor and disability insurance programs that provided retirement benefits ranging from 20-70% of final earnings.

2. Assistance. The approach to old age assistance in France, Switzerland, the United Kingdom and the United States is very similar to the approach in this country under the Guaranteed Income Supplement (GIS) and the Canada Assistance Plan (CAP). Assistance is provided under national programs to residents who do not have adequate retirement income as determined by means or needs tests. The Netherlands and West Germany seek to provide even the lowest-income employees with some insurance coverage under the national plan, rather than to leave it to old age assistance to provide all or part of their retirement income. In the Netherlands, the government pays the contribution for such low-income persons, while in Germany the employer contributes at twice the normal rate. Although old age assistance is ultimately available at the local government level in both of these countries (with national financial support in the Netherlands), it appears to have become an insignificant factor in West Germany's retirement income system. In other countries, means- or needs-tested old age assistance is generally provided by the state where no old age insurance or universal pension scheme exists or where the benefits provided by one or the other, or both, are inadequate to meet the needs of the elderly. In Sweden, an automatic supplement to the universal pension is payable to those who do not qualify for the earnings-related pension, and housing allowances are paid through a means test administered by local authorities.

B. Public Pension Plans

1. The Level of Pensionable Earnings. The earnings level to which the public pension plans apply is relatively higher in the other seven industrial countries than in Canada. While the amount of earnings covered by the Canada Pension Plan was very close to the level of average wages and salaries (AWS) when it was initiated, it fell steadily behind for a number of years because of a ceiling of 2% imposed on the maximum permissible increase annually in the level of earnings covered by the Plan. The level of maximum pension earnings under the CPP is currently being increased at the rate of 12 1/2% a year until it is restored to the level of average wages and salaries. As of 1978, however, it was still 25% below the average wage and salary level. In

the other countries, the level of earnings covered by the public plans ranges from the average of wages and salaries to an unlimited amount, with most falling between 1.5 and 2 times average wages and salaries.

2. The Amount of Retirement Income Provided by the Public Pension Systems. Figures 1, 2 and 3 give some indication of the relative size of benefits provided by the public pension programs of the eight industrial countries. The comparisons, which employ 1977 data, are based on the amount of income received by one-earner couples in the first year of retirement as a proportion of gross earnings just prior to retirement. In the case of Canada, Sweden and the United Kingdom, all of which have earnings-related pension plans that have not yet matured, the proportions are shown both as they actually were in 1977 and as they would have been in that year if the plans had reached maturity. In addition to the CPP, benefits provided in Canada include those from the OAS and GIS.

FIGURE 1

Public Pensions as a Percentage of Gross Earnings Just Before Retirement

One-Earner Couples with Earnings Present Throughout Work Years

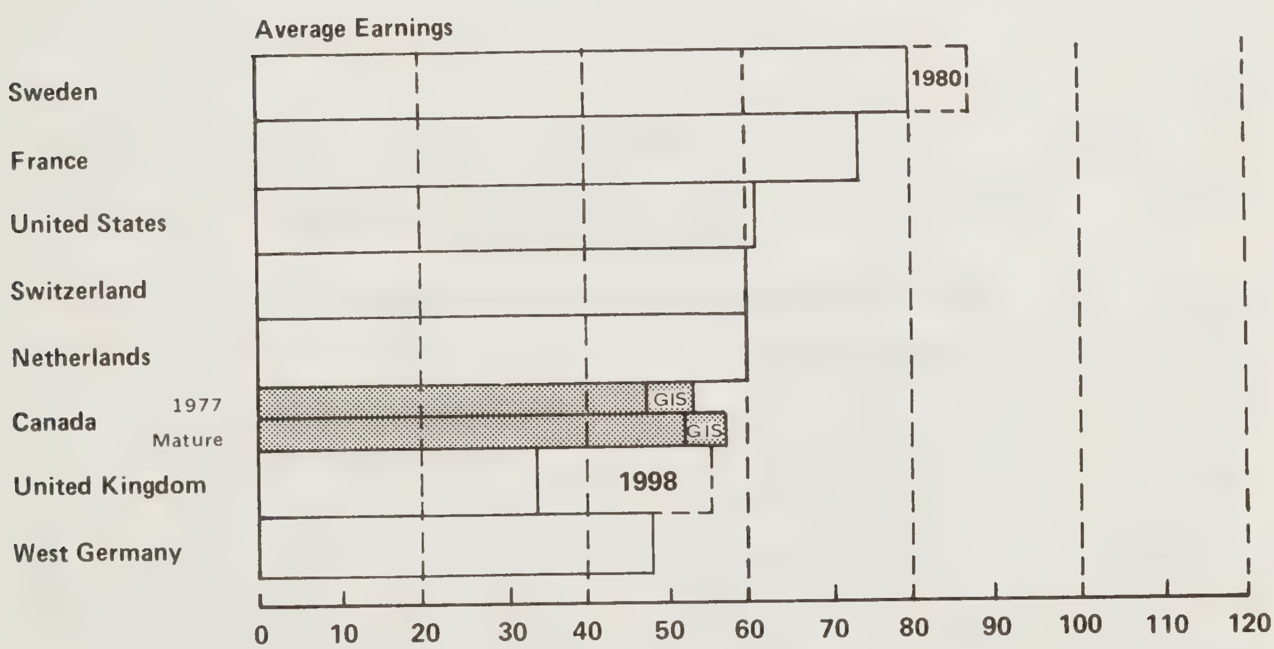


FIGURE 2

Public Pensions as a Percentage of Gross Earnings
Just Before Retirement

One-Earner Couples with Earnings Present Throughout Work Years

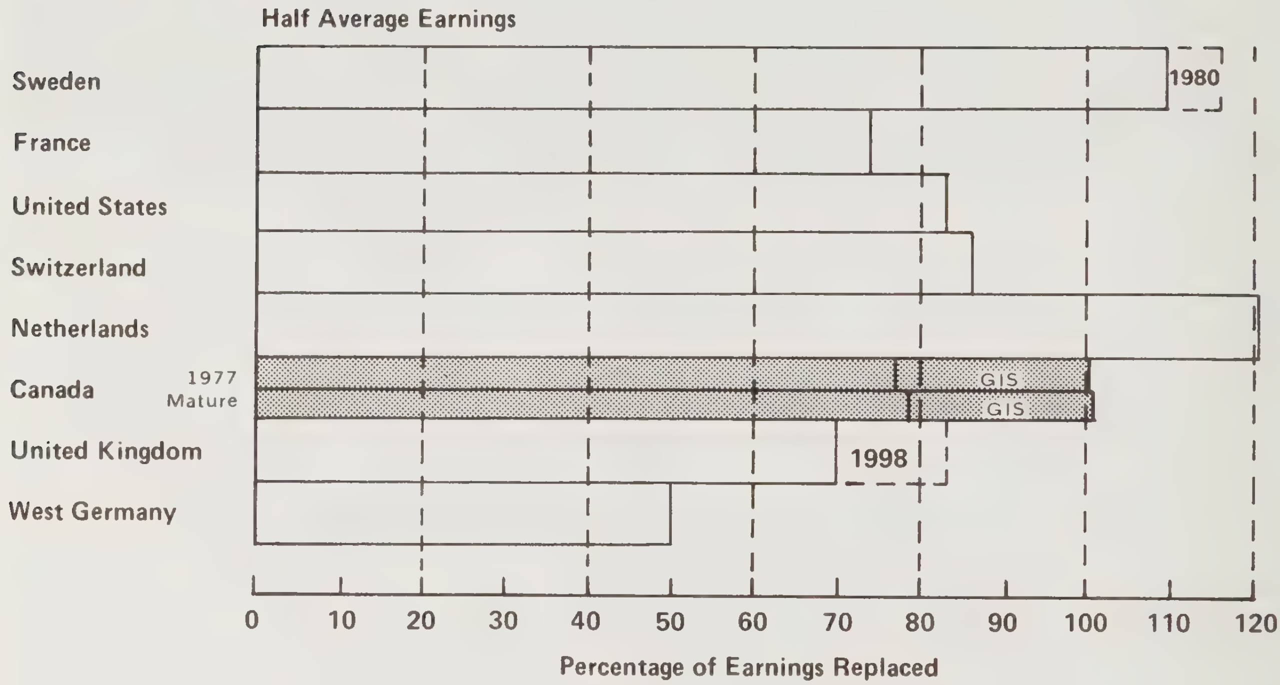
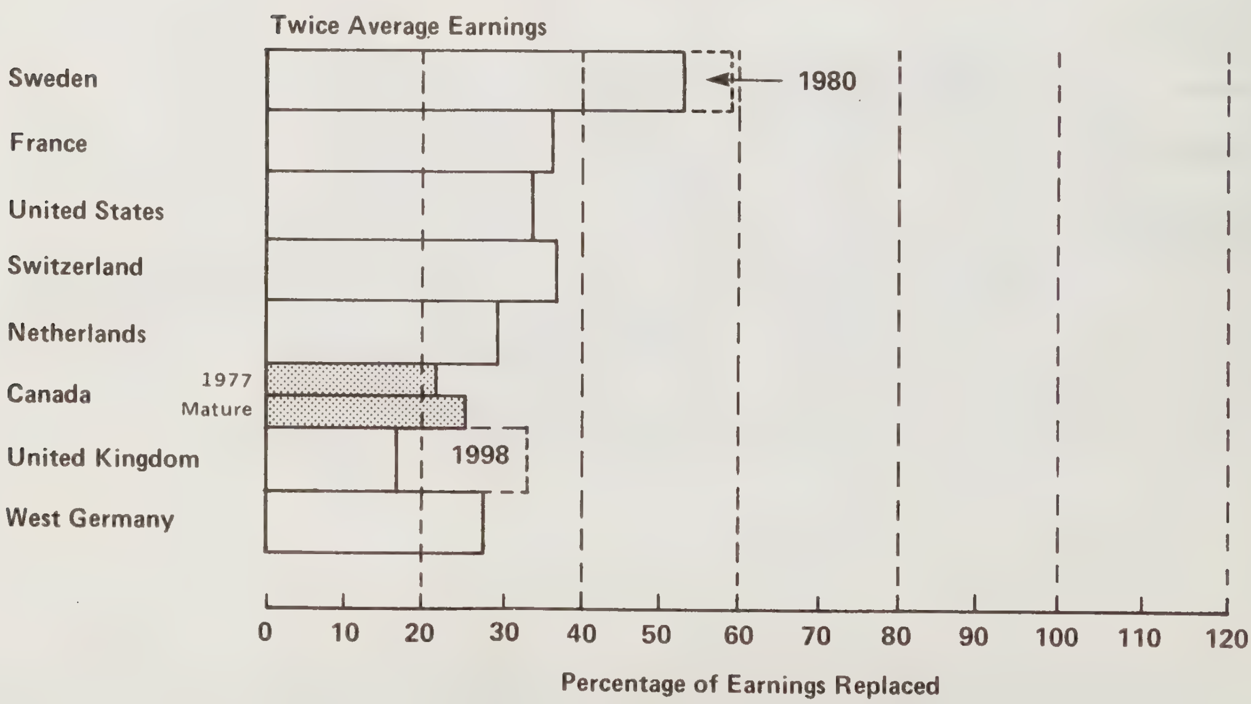


FIGURE 3

Public Pensions as a Percentage of Gross Earnings
Just Before Retirement

One-Earner Couples with Earnings Present Throughout Work Years



Only in the case of Canada are benefits shown as being payable under an income-tested plan - the GIS. In the seven other countries, income-tested pension plans at the national level do not provide additional retirement income for persons at these retirement income levels. Other forms of assistance are provided to the elderly by the other governments in those countries, as is also the case in Canada, but these programs are difficult to evaluate on a comparable basis.

It will be evident that the GIS, in combination with the OAS, was an important factor in raising the retirement income available to those who were in the low-income range during their working years (earning one-half of average wages and salaries) above the average provided in the other seven countries. In relative terms, however, those Canadians whose earnings prior to retirement equalled average wages and salaries received income in retirement which was slightly below the average in the other countries because of the declining role played at this level by the GIS. For those Canadians who earned twice as much as AWS, the proportionate amount of income available in retirement was well below the average in those countries.

These Figures, depicting the results in the case of one-earner couples, put Canada in a somewhat more favourable position compared to the other countries than in the case of single persons and two-earner couples at these income levels. The relationships in the other two categories are shown in Figure 1, 2 and 3 of the Annex to this paper. In the case of both single persons and two-earner couples at the half average earnings level, Canada drops from third to fourth place among these countries, while at each of the other two earnings levels Canada drops to eighth place after the present national plans mature.

C. Maintaining the Value of Public Pension Benefits

Most industrial countries have adopted some method of adjusting the amount of public pension benefits so as to maintain to varying degrees their real value in relation to prices and/or wages. Different methods are applied before and after retirement, as will be seen from Table 1.

Prior to retirement, the majority of these industrial countries provide for the 'revaluation' of earnings received during the earlier years of membership in the public plans so as to offset or reduce the impact of inflation. One example is provided by the Canada Pension Plan. The amount of benefits available to a person retiring in 1979 would be calculated by first determining the average of the Year's Maximum Pensionable Earnings (YMPE) covered by the plan for the years 1977, 1978 and 1979. Next, a calculation would be made of the ratio that average bears to the maximum pension earnings under the plan in each of the years an individual was a member. The actual pensionable earnings received by the individual each year would then be multiplied by the ratio for that year so as to revalue the amounts taken into account for determining the CPP pension benefits payable.

Various methods are applied in the different industrial countries in order to adjust benefit payments following retirement, but most provide for them to be revalued periodically by full or partial indexing of pensions to prices and/or wages.

Table 1

Methods of Maintaining Value of Public Pension Benefits

Country	Pre-Retirement	Post-Retirement
Canada	revaluation of earnings in benefit formula	CPP - indexed annually to CPI; OAS - indexed quarterly to CPI
France	"	adjustments twice annually related to wage index
West Germany	"	annual adjustment related to wage index if Parliament approves
Netherlands	improvements in flat rate benefit level	at least once every six months for 3% rise in wage index since last change
Sweden	revaluation of earnings in benefit formula	once a month for a minimum 3% rise or fall in the price index since last change
Switzerland	"	every two years related to a combined wage and price index or earlier for 8% increase in CPI in a year
U.K.	"	earnings-related benefit adjusted annually in relation to CPI; flat rate benefit annually in relation to higher of wage or price index
U.S.	improvements in benefit formula	adjusted annually for a minimum of 3% increase in CPI

In 1977, 38 countries had some form of indexing, with 20 using a price index primarily, 15 a general wage index primarily, and two a minimum wage index, while Finland used the price index for its universal plan and the general wage index for its earnings-related pension plan.

Table 2 sets out the increases in pension, wage and price indices in the eight countries appearing in Table 1. It shows some interesting relationships between the movement of pension levels in each country and the price or wage index with which the changes in the pension index are directly or indirectly related at the present time.

Table 2

Changes in Pension, Wage and Price Indices of Eight Industrialized Countries, 1960-1974

Country & Index	1960	1965	1970	1971	1972	1973	1974
Canada							
Pensions(1)	100	136	145	145	145	175	204
Wages	100	115	161	175	181	204	226
Prices(2)	100	108	131	135	141	152	168
France							
Pensions(3)	100	173	254	280	310	344	379
Wages(2)	100	143	219	241	268	322	347
Prices	100	120	149	157	166	179	203
West Germany							
Pensions(4)	100	142	203	216	237	264	293
Wages(2)	100	153	219	241	260	297	311
Prices	100	115	131	138	145	155	162
Netherlands							
Pensions(5)	100	232	381	442	473	547	645
Wages(2)	100	148	229	260	287	325	n.a.
Prices	100	118	149	160	173	187	204
Sweden							
Pensions(1)	100	154	209	232	245	259	295
Wages(6)	100	148	212	229	249	264	n.a.
Prices(2)	100	120	149	160	169	181	198
Switzerland							
Pensions(7)	100	173	260	285	285	519	649
Wages	100	140	196	221	245	276	310
Prices(2)	100	117	139	148	158	172	189
United Kingdom							
Pensions(8)	100	160	208	240	270	310	400
Wages(2)	100	127	182	197	228	261	309
Prices(2)	100	119	149	163	174	191	221
United States							
Pensions(9)	100	107	139	153	184	184	205
Wages	100	120	149	158	172	185	197
Prices(2)	100	107	131	137	141	150	167

(1) Increases in universal pension only; excludes earnings-related pension.
(2) Index in relation to which pensions are now adjusted.
(3) Based on wage-related coefficient of indexing since 1965; ad hoc adjustments adopted previously.
(4) General computation base.
(5) Increases in flat rate benefit.
(6) Average monthly wages.
(7) Based on increases in the maximum benefit amounts that apply equally to benefits in force; indexing instituted in 1969.
(8) Increases in flat rate benefit amount; based on ad hoc adjustments until 1971.
(9) Ad hoc percentage increases in benefits. Benefit changes based on price index effective 1975.

Note: In the case of Canada, Sweden and the United Kingdom, the index does not take account of plans such as the CPP, which would have the effect of distorting the comparison with other countries because they were in the process of being phased in during part of this period.

West Germany is the only country in which the pension index has risen less than the other index on which changes in the pension index are based - in this case a wage index. This is due to the effect of relating the increases in pensions to the increase in the average of the wage indices of more than one previous year. On the other hand, the British, Dutch, French and Swiss pension indices are considerably higher than the related price index as a result of a series of special adjustments to bring pensions up from levels which were felt to be too low.

Canada had the second lowest increase in the wage index and the third lowest increase in the CPI over this period. It followed the United States, which was first and second respectively. Their pension index increases were also the lowest. Thus, the three indices generally increased much more in the Western European countries than in Canada and the United States, reflecting the consequences of higher rates of price and wage increases in Western Europe.

D. Financing

The earnings-related old age security plans outlined in Section B are financed primarily by means of a payroll tax, supplemented in some cases by government subsidies from general revenues. In fact, this method of financing has been adopted for most social security programs. There are wide variations in rates, depending on the types and extent of the programs involved, as shown in the range of payroll tax rates for January 1979 in Table 3. These are illustrative rates which have been rounded, applying to earnings with different maximum and minimum levels from country to country, as well as within each country.

Table 3

Social Security Payroll Tax Rates, January 1979

Country	For Old Age, Disability, and Survivor Insurance(1)			For All Social Security Programs		
	total	employee	employer	total	employee	employer
			(% of payroll)			
Austria(2)	19.5	9.25	10.25	29.4	13.4	16.0
Belgium(3)	14.0	6.0	8.0	33.6	9.7	23.9
Canada	3.6	1.8	1.8	6.8	3.1	3.7
West Germany	18.0	9.0	9.0	35.0	16.5	18.5
France	12.9	4.7	8.2	51.4	11.3	40.1
Netherlands	19.0	11.9	7.1	50.8	23.7	27.0
Norway	24.7	8.2	16.5	24.7	8.2	16.5
Sweden(4)	20.3	-	20.3	35.3	-	35.3
Switzerland	9.4	4.7	4.7	15.4	5.4	9.9
United Kingdom	15.3	6.1	9.2	16.5	6.5	10.0
United States(5)	10.2	5.1	5.1	12.3	6.1	6.1

(1)The percentages shown include financing for some programs in addition to old age, disability, and survivor insurance in the Netherlands, Norway, Spain, and the United Kingdom. Excluded are financing for disability insurance in Belgium and for disability and survivor insurance in France that are covered by separate payroll taxes under the health insurance programs.

(2)The employee and employer rates for salaried employees for all social security programs are 0.65% less.

(3)The employer rate for hourly paid workers is 15.25% more, while for employees it is 0.4% more.

(4)In the case of Sweden, the employee makes contributions indirectly through other types of taxes. The employer contributes for all social security programs as shown as a percentage of gross payroll for hourly paid staff. The rate is 35.1% for salaried staff. In addition, both types of employees receive other fringe benefits provided by the employer under collective agreements.

(5)Excluding Unemployment Insurance contributions which vary with experience and from state to state.

Note: Numbers may not add due to rounding.

It should be noted that, in the case of the old age, disability and survivor benefits, tax rates run from a low of 3.6% of payroll in Canada to a high of 24.7% in Norway. The rate in Canada is by far the lowest of all the countries shown. Canada's total payroll taxes for all social security programs as a percentage of payroll of 7.8% is also significantly lower than that in all the other countries shown, comparing with the high of 51.4% in France. This is a reflection of the fact that a much higher proportion of social security programs in Canada are financed from general revenues rather than from specially earmarked payroll taxes. It should also be noted that while some countries have equal employer/employee rates of contribution, about half impose higher contribution rates on employers than on employees.

Of the seven countries whose plans have been studied in detail, all have adopted what will eventually become a pay-as-you-go method of financing. The programs in these and other countries which have sizable reserves in their old age insurance funds are, for the most part, relatively new and will not pay full benefits for some time. When they do, however, the accumulated funds are expected subsequently to dwindle.

Sweden, which levied high payroll taxes from the commencement of its earnings-related plan, has built up by far the largest fund. However, even its plan was designed to be on a pay-as-you-go basis by the middle of the next century. This fund was about 33 times the annual amount of benefits paid in 1970, 20 times in 1974 and 11 times in 1978. This is a much faster rate of reduction in growth in relation to annual expenditures than was estimated some years ago, when it was calculated that the peak would be reached in 2010. By comparison, the Canada Pension Plan fund was about 45 times the annual benefit level in 1970, 22 times in 1974 and 12 times the annual expenditure in 1978. This slightly faster rate of reduction in growth than in Sweden is a result of lower contribution rates, which are not fully offset by lower benefit levels in Canada. The more usual relationship in other countries is one where the size of the fund is only a few times the monthly expenditure. This is the case now in France, West Germany, Norway, the U.K., and the United States. Thus, Canada has one of the largest funds in relation to annual expenditures at the present stage. However, the amendments in the U.S. plan - enacted in December 1977 - will produce a somewhat larger fund, an estimated eight to nine times its monthly expenditure by 1987 instead of three to four times when the amendments were introduced.

E. Age of Retirement

The relationship between ages of eligibility for old age pensions, retirement from employment, and delayed or advanced retirement in the national plans of the countries under review is set out in Table 4.

Table 4

Conditions of Eligibility for National Retirement Pensions

Country	Age of Eligibility for Pension Benefit	Retirement Status for Pension Eligibility	Adjustment in Pension Formula for Later or Earlier Retirement
Canada	65	retirement not reqd.	no
France	65	retirement not reqd.	yes from 60 to 70
West Germany	65 (or 63 & 35 yr. participation; female 60 & 15 yr. participation of which 10 in last 20)	retirement reqd.	yes for delay up to 67
Netherlands	65	retirement not reqd.	no
Sweden	65	retirement not reqd.	yes from 60 to 70
Switzerland	males 65, females 62	retirement not reqd.	no
United Kingdom	males 65, females 60	earnings test	yes for delay to 70 for males, 65 for females
United States	65	earnings test	yes from 62 to 72

As Table 4 indicates, there is a good deal of flexibility permitted to an employee under a majority of the national plans in the choice of the age of eligibility for benefits. Moreover, eligibility for benefits is not dependent on retirement from employment in five of these countries. Some countries, such as Sweden, are experimenting with gradual early retirement and partial pensions. About 21% of the gainfully employed persons in the 60 to 65 age group in Sweden took advantage of this option in the first eighteen months. It is still too soon to assess the long-term consequences.

Some countries are offering temporary inducements over the next few years in the form of salary continuance, for example, up to the eligibility age under the pension plans in the hope that older employees will retire early to make positions available for the unemployed youth.

Given the demographic trend toward a growing proportion of the elderly in the population and the declining proportion of those of working age, the longer-term concern of a number of countries is the very opposite of that at present. Their concern stems mainly from the growing cost involved in providing for a permanent reduction in the retirement age and the effect of such a move in reducing the number of workers in the labour force. The West German social security system, for example, encountered financing problems when an unexpected 83% of eligible German workers took advantage of a 1972 reduction in the retirement age from 65 to 63.

In 1975, out of a total of more than 100 nations, the national plans of 57 countries provided full pensions on early retirement for one or more of a variety of qualifying conditions.(1) As Table 5 indicates, 42 of the 57 countries recognized one condition, 12 recognized two conditions, and three recognized three conditions. In addition, seven other countries provided reduced pensions for retirement ranging from three to ten years earlier than the normal age.

Table 5

Conditions for Full Pensions on Early Retirement under the National Plans of Several Countries

	Conditions												Combined Total
	A	AB	AC	ABC	AD	B	BC	BD	BCD	C	CD	D	
A	17	3	2	2	1								25
B		3		2		11	1	3	1				21
C			2	2			1		1	11	2		19
D					1			3	1		2	3	10

A - Engaged in "arduous, unhealthy or dangerous employment" where, on average, the working capacity of persons employed is diminished relative to others.
B - On completing the length of service requirements under the plan, with no lower age limit in eight cases.
C - Workers in failing health, the physically handicapped or unable to work, or prematurely aged.
D - Involuntarily unemployed for certain periods in the year before claiming benefits.

(1)A similar analysis in respect of the 1977 survey is not available.

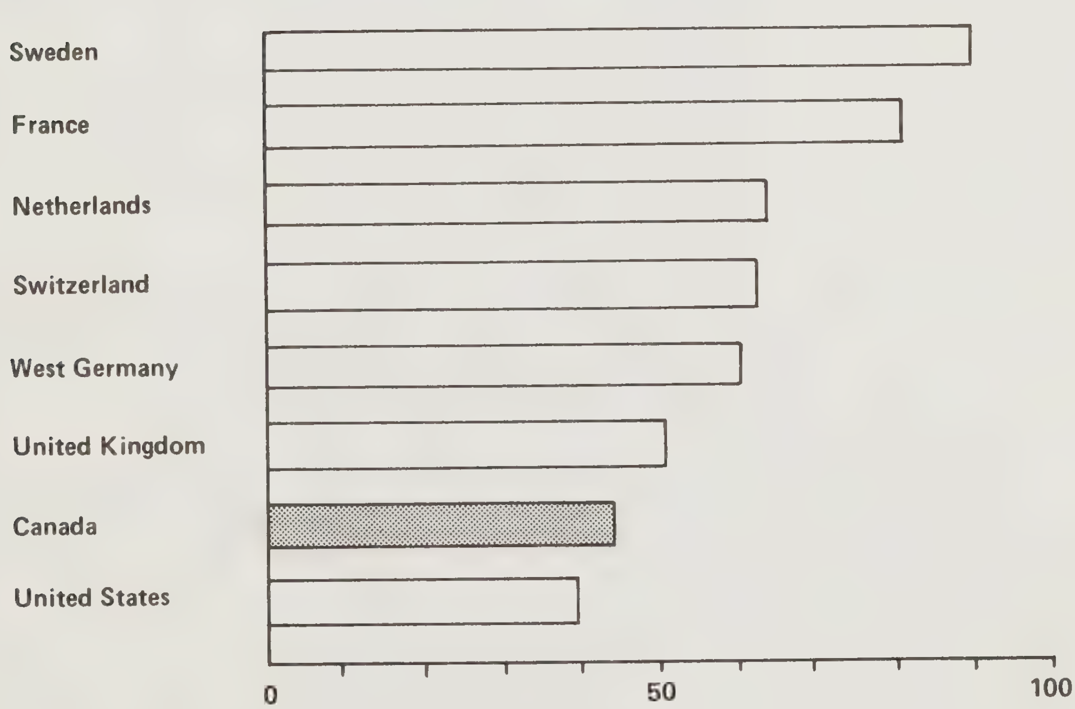
F. Employer-Sponsored Pension Plans

1. Coverage. In the case of the eight industrial countries being examined most closely, it would be difficult to conclude that the level of retirement income provided to employees on retirement is satisfactory for all of the elderly if individual employers are not required to provide pension plans for their workers to supplement state programs. While the larger employers usually sponsor such plans, the vast majority of smaller employers do not do so in Canada and most of the other industrial nations. In those countries where some form of compulsion exists, it is confined to the larger companies in the major industries. As a result, employees of smaller firms are denied the benefit of supplementary pensions. Even where plans are in operation, the range in the level of benefits provided is usually very wide, with the result that there is widespread and continuing pressure in many countries to provide higher levels of coverage under universal state plans or to require the establishment of private plans by all employers which provide some minimum level of benefits.

Figure 4 provides some indication of the proportion of employees covered by employer-sponsored pension plans in the eight industrial countries after adjustment to put the data on a comparable basis.

FIGURE 4

Proportion of Paid Workers in Canada and Seven Other Countries Covered by Employer-Sponsored Pension Plans, 1976



Approximate

The figure above indicates that employers in European countries have higher coverage ratios than either Canada or the United States. In most countries, as in Canada, the gaps in coverage are greatest among the small employers. This factor was partly responsible for the introduction of the mandatory state/private earnings-related plan in the U.K. in April 1978, and the proposals for mandatory private plans under consideration in the Netherlands and Switzerland.

2. Financing. With the exception of France, the financing of most private employer pension plans follows the full funding approach, as seen from the following summary:

Canada - At the beginning of 1976, 72% of the plans covering only 13% of the members were funded with insurance companies. On the other hand, about 25% of the plans with two-thirds of the members were funded either with a trust company or individual trustees. The remainder were largely funded through government consolidated revenue funds which were not invested through financial markets.

France - Repartition - Slightly better than pay-as-you-go, with each year's contributions designed to provide for old age and survivor pensions, expenses and minimal reserves.

West Germany - The four main methods of financing permitted, all subject to government supervision, are:

- Direct Insurance from private insurers, under which annuities, sometimes combined with other benefits, are purchased directly from a private insurer as are group annuity plans in Canada;
- Pension Funds under which pension reserve funds are set aside irrevocably in a separate pension institution, analogous to the way trusteed pension funds are held by trust companies in Canada;
- Support Funds up to certain limits are placed in special legally autonomous institutions from which they may be, and often are, borrowed back by the employer as unsecured loans;
- Pension Reserves not represented by specific assets or notes are established in the accounts and balance sheet of the employer.

Employers are required to carry insolvency insurance with the exception of: (1) those directly insured plans where the members have an irrevocable right to the benefit and no loan has been effected; and (2) the plans using pension fund institutions.

Netherlands - The first two methods used under the German system are used in the Netherlands. Gradual attainment of fully funded status is permitted, particularly in respect of past service liabilities incurred at the inception of a plan.

Sweden - Two basic methods are available: direct insurance or a book reserve system under which pension commitments are guaranteed by plan termination insurance.

Switzerland - Two basic methods are available, both subject to governmental supervision, namely, direct insurance from private insurers and autonomous pension funds.

U.K. - Occupational pension plans in the private sector are almost always funded through:

- insurance, meaning any arrangement under which an insurance company receives the funding payments, either directly or through a trust; and

- a 'self-invested pension trust', meaning a trust fund invested directly in securities by the trustee.

United States - Under the Employee Retirement Income Security Act of 1974, a company must fund the costs of benefits currently being earned by employees. But it only has to pay interest on past service costs covering benefits granted to employees for earlier service when a plan was first set up, or when a benefit formula was improved retroactively. In order to comply with Internal Revenue Service regulations, the company must fund normal costs on a current basis and past service liabilities existing before 1974 over no less than 40 years. In addition, any past service costs created after 1975 must be amortized over a 30-year period (40 years in the case of a multi-employer plan). The funding standards are made applicable to pension plans of employers and employee organizations involved in interstate commerce. Government plans and church plans, as well as profit sharing plans and plans of unions funded exclusively by contributions of union members, are exempt. The Internal Revenue Service may waive temporarily the funding requirement if an employer would otherwise face substantial business hardship. The amount waived is to be amortized over 15 years.

This Act also provides for the creation of the Pension Benefit Guaranty Corporation, which provides compulsory termination insurance for defined benefit plans.

3. Portability and Vesting. Portability provided through the transfer of pension credits when an employee moves from one employer to another is virtually non-existent in the case of single-employer plans. However, this type of portability is provided in countries, such as France, which have separate country-wide plans for managerial and non-managerial employees, and in countries such as West Germany, the Netherlands and Sweden, where industry-wide plans are common. The same is also generally true of multi-employer plans in other countries. In Britain, there are also arrangements for transfer of pension fund credits among plans in the public sector. The outline below provides a summary of the degree of portability provided in each of the eight countries through the vesting of employee pension rights under employer-sponsored plans and the locking in of employee contributions. Unless otherwise indicated, the employee contributions become locked in at the same time that vesting occurs.

Canada - Age 45 and 10 years membership in the plan.

France - Full and immediate with no age or service requirement.

West Germany - Age 35, when combined with either:

- ten years membership in the plan; or
- three years membership in a new or amended plan for those with twelve years service with the employer.

Netherlands - One year membership in the plan, except in case of emigration.

Sweden - Age 28 with no service requirement for white collar workers. Minimal or no vesting for other workers.

Switzerland - Five years membership at present with no locking in. Age 25 and nine months service under proposed legislation except in case of emigration, female employees who marry, and any employee who becomes self-employed.

U.K. - Commencing April 1980, age 26 and 5 years service, but employee may opt for return of contributions in respect of service prior to April 1975.

United States - Three options:

- graded vesting beginning with 25% after five years, increasing five percentage points each year until ten years of service, then increasing by ten percentage points annually until 100% is reached after 15 years service;

- 100% vesting after ten years of service; or

- a "Rule of 45" whereby 50% of the benefits would be guaranteed when age and years of service totalled 45 and would increase by ten percentage points annually for the next five years.

There is no locking in required by the Employee Retirement Income Security Act. This reflects the decision of Congress that the legislation should not interfere with the right of the parties to the plan to provide for cash withdrawals even on retirement. Thus, a pension plan in effect was regarded as a general savings program, with all the flexibility which one would want on ceasing to be a member of the plan.

4. Pre- and Post-Retirement Adjustment for Inflation. In most of the countries surveyed, there is a general trend toward an improvement in the adjustment for inflation of benefits accruing prior to retirement, frequently through the adoption of final average pay plans and a reduction in the number of years on which that average is based. This approach has the effect of revaluing the earnings from earlier years of employment that form the basis for calculating pension benefits. In the case of employees who move from one plan to another, however, such revaluation of deferred pension benefits is common only in France and Sweden. It will be evident from the summary that follows, however, that there is a wide variation in the procedures followed within the eight countries for adjusting benefits being paid out under employer-sponsored plans following retirement.

Canada - Surveys indicate that adjustments to pensions-in-pay were general among employers with 500 or more employees, but much less common among smaller employers. A rough estimate is that, over the last five years, the pensions of those who formerly worked in the public sector have been adjusted to correct on average for something over half the inflation that occurred. In the private sector, such adjustments are estimated to have corrected for well under half the inflation that occurred.

France - Increases in plan benefits are determined annually in accordance with actuarial projections about the future state of the fund over the following ten years. These projections are based on estimates of revenue from new contributions and interest on the reserve fund, and of benefit payments over that period, having regard to the maintenance of a minimum reserve fund. The overall effect of the increases made over the years from 1960 to 1974 has been very close to that shown in the pension index for France in Table 2, which is related to the wage index.

<u>West Germany</u> - A judicial review is required every three years to determine whether an adjustment is warranted, taking into consideration both wage and price developments, as well as the financial ability of the employer to provide increases. Since this requirement was introduced under a new law only late in 1974, it is too soon to assess the results completely. Reports indicate that the rate of increase in pension payments has amounted to about 50% of the increase in consumer prices.

<u>Netherlands</u> - Provision for adjustment exists in some 57% of plans covering 90% of plan members. Plans with definite commitment usually are limited to increases from 3-6% in relation to prices. Under proposed legislation, adjustment would be required in relation to the cost of living index.

<u>Sweden</u> - Benefits are subject to adjustment on a monthly basis of at least 3% in accordance with changes up or down in prices since the last previous change was made.

<u>Switzerland</u> - No pattern is apparent. Under proposed legislation, adjustment would be required in relation to the cost of living index.

<u>U.K.</u> - No pattern is apparent; a wide range of ad hoc adjustments exists in the private sector. Benefits under the contracted-out equivalent of the compulsory state earnings-related plan, which commenced in April 1978, will be indexed generally in relation to national average earnings under one of three optional methods for employees who leave before normal retirement age under the state plan and in relation to prices after retirement. This applies in the case of the private contracted-out plans where the National Insurance Fund will pay the indexed portion of the contracted-out benefits after retirement.

<u>United States</u> - No pattern is apparent, but here again a wide range of ad hoc adjustments takes place in the private sector.

G. <u>Taxation Arrangements</u>

In general, assistance allowances subject to a means or income test are not taxable. This is not true of the benefits paid by the pension schemes proper, however, whether they are basic flat rate pensions or earnings-related retirement pensions. These benefits are usually regarded as normal income and taxed in the same way as income from other sources. In countries where taxation is progressive, net pension benefits

may thus be appreciably lower than the gross benefits. However, there are exceptions, as shown in the following summary comparison made in 1976 of 17 countries by the Swiss Reinsurance Company of Zurich.

1. State Social Security Schemes. Statutory contributions of employers in all countries to government pension programs are fully deductible from taxable income and are not considered as income of the employee. The position of the statutory contributions of employees or insured persons with respect to taxation varies considerably, however. They are:

- fully deductible in nine countries (Austria, Belgium, Denmark, France, the Netherlands, Sweden, Switzerland, Canada and Japan);

- deductible to a limited extent in two countries (West Germany and Spain);

- not deductible in three countries (Finland, Britain and Norway); and

- in two countries (Australia and South Africa) there are no specific contributions on the part of employers and employees.

The tax treatment of pension benefits also varies widely. Benefits are:

- exempt from taxation in four countries (Finland, Spain, the Netherlands and Australia; in the latter two countries, however, pension benefits are only tax-exempt if they represent the only income of the beneficiary);

- partially taxable in six countries (Austria, Belgium, France, West Germany, Switzerland and Japan); and

- fully taxable in six countries (Denmark, Britain, Norway, Sweden, Canada and the United States).

2. Employer-Sponsored Pension Plans. In most countries, contributions of employers to their own private plans are fully deductible; there are certain limits on the deductible amounts in Austria, West Germany, Spain, Canada, Australia, South Africa and the United States.

Insurance carriers are in most countries also fully or partially exempt from direct taxes on their occupational pension and insurance fund investments. They are subject to taxation on their profits on investments in Denmark, Japan, Canada and the United States. In some countries, the tax liability is made contingent on whether the employer himself or another independent body is the insurance carrier.

The employer's contributions are usually not considered as income of the employee, but employees are partially taxed on those contributions in West Germany, Norway, Japan and the United States.

Contributions of employees are fully deductible from taxable income in eight countries (Austria, Belgium, France, Britain, the Netherlands Norway, Sweden and Japan) and, under certain circumstances, are partially deductible in a further eight countries (Denmark, Finland, West Germany, Spain, Switzerland, Canada, Australia and South Africa). In the United States, employee contributions are not deductible from taxable income; most pension schemes, however, do not provide for any contributions on the part of employees.

Lump-sum payments upon termination of employment are tax-free in five countries (France, Britain, Norway, Sweden; in West Germany only in certain cases). In all other countries, such capital payments are subject to taxation, but considerable reductions are allowed. Pension benefits are entirely tax-free only in Spain, but they are partially subject to taxation in Austria, Finland, France, West Germany, Switzerland, Canada and the United States. They are fully subject to taxation in Belgium, Denmark, Britain, the Netherlands, Norway, Sweden, Australia, Japan and South Africa.

3. General Observations. It appears on balance that full tax deduction of contributions is prevalent in the social security sphere; full or limited contribution deduction, as well as a complete absence of tax relief, can be found in respect of employer-sponsored schemes; and limited deduction of contributions for tax purposes is the rule as far as private individual annuity purchases are concerned. It is interesting to note that contributions paid to state schemes and to employer-sponsored plans are not always treated the same within the same country. For example, employee contributions to the state scheme in Norway and the U.K. are subject to tax, but fully deductible under their employer's plans. In the majority of countries, the treatment of social security pensions and pensions provided under private plans is basically the same. Pensions from both sources are fully taxable as income in nine countries, partially taxable in four, fully exempt in one, and unequally treated only in three countries.

H. The Resulting Levels of Retirement Income

This section provides an indication of the relative amount of retirement income provided to the elderly in the eight industrial countries under the combined state and private plans currently in operation or that would be provided under new plans being actively considered. The estimates with regard to retirement income generally apply only to the elderly who fully participate in employer-sponsored plans during most of their working years and do not apply to those who were unable to qualify for such benefits for any one of many reasons - including the limited coverage provided by such plans in most countries.

Canada - No national objective has yet been developed for the amount of retirement income that should be provided from combined public and private plans. In many of the better plans, employees with long service to their credit under one employer-sponsored plan whose earnings were at the level of average wages and

salaries can receive combined public and private pension income after taxes that would enable them to more or less maintain their pre-retirement standard of living. The proportion of employees who would qualify for pensions at this level, however, is probably quite small. The only officially accepted percentage with respect to retirement income is that included among the requirements for registration of a defined benefit pension plan under the Income Tax Act, which limits the amount of benefits under that plan to 70% of the pensioner's average salary during the last three years of employment, regardless of the amount of public pension to which he is entitled.

France - The overall objective for the bulk of employees is to provide pension income of 60-70% of final year's pay, with some managerial and executive personnel ranging as high as 80%. In the case of the very highly paid, however, benefits sometimes amount to no more than 50% of final earnings.

West Germany - The retirement income objective of most private plans is to produce combined state and private pensions of 65-75% of final or final average pay.

Netherlands - The level of benefits under private single-employer plans frequently provides a career employee with combined state and private pension plan income of 70% of final earnings. The level is usually lower under multi-employer plans.

Sweden - After the earnings-related plans start to mature in 1980, the combined universal and earnings-related plans are designed to produce 55-60% of final salary up to the earnings ceiling (about 1 1/2 times AWS). The complementary private plans are designed to produce overall benefits equal to 65% of average revalued earnings up to about 4 1/2 times the average wage and 32 1/2% of the average revalued earnings between 4 1/2 and 6 times the average wage.

Switzerland - The objective under the proposed mandatory plan is to provide combined state and private pensions of 60% of final earnings.

U.K. - After the new earnings-related plan matures in 1998, the combined basic and earnings-related pension will produce pensions in excess of 50% of final earnings for those at the lowest end of the earnings scale, and in the area of 35% of the earnings ceiling for those whose final earnings are above that ceiling. It is still too early to say what pattern will

emerge among private supplementary plans, but the present overall ceiling of two-thirds of final pay under tax legislation may well constitute the effective ceiling for combined state and private plan benefits.

United States - The Social Security Program currently provides a maximum single pension of 57% of the previous year's covered earnings for a low-earning individual, but drops gradually to 27% for the individual with maximum pensionable earnings. No national objective has been developed, but various surveys report sharp rises in benefit levels under existing employer-sponsored plans, due to improvements in benefit formulae and higher earnings. In 1974, a Bankers Trust Company study reported that workers in final pay plans whose average earnings shortly before retirement amounted to between $8,000 and $10,000 - approximately the prevailing median - received replacement income from this source in retirement ranging from 33-41%.

I. Position of the Canadian System in Relation to Other Countries

Following is a comparison in summary of the principal features of the Canadian retirement income system - public and private - with those of the seven other countries.

1. The Public System.

a) The major difference in the basic structure of the Canadian public system compared with the systems of over one hundred countries with national old age insurance plans is that Canada - along with only Denmark, Finland, Mauritius, Norway and Sweden - provides universal grants to the elderly (OAS in the case of this country).

b) Even with OAS, however, the combined retirement income from that source - together with the maximum available from the Canada/Quebec Pension Plans (C/QPP) - is still generally in the low to middle range in relation to other countries as a percentage of final or final average earnings prior to retirement. The Canadian position is favourable for those at lower-income levels during their working years because of the combined benefits from OAS and the income-tested GIS. A one-earner couple whose income prior to retirement was half the level of average wages and salaries would receive just over 100% of that amount following retirement. The relative position of the elderly in Canada declines, however, in respect to those who were at higher earning levels during their working years; a one-earner couple whose income from employment was twice the level of AWS would receive income in retirement equal to only around 22% of that amount - well below the average in the other seven industrial countries.

c) Among the 38 countries with regular indexing of benefits, Canada is one of 20 which use the price index, with quarterly indexing of OAS and

GIS benefits providing more frequent adjustments than is common among other plans.

d) The collection of CPP contributions through a payroll tax and the establishment of a contribution rate which would lead to virtual pay-as-you-go financing once the system matures is similar to that followed under the old age insurance plans of the majority of 114 countries reviewed. In most of these countries, the size of the fund is much less in relation to annual benefit expenditure than under the CPP at the present stage of its development. In Canada, the fund at the end of 1978 was almost 12 times the <u>annual</u> benefit payments, a little higher than in Sweden, whereas in France, West Germany, Norway, the U.K. and the United States, the funds are only a few times the <u>monthly</u> benefit payments.

e) The plans in 64 countries are more flexibile than Canada's in the age of eligibility for pension; several of them provide adjustments in the pension level for commencement of pensions later or earlier than the normal age of entitlement.

2. <u>The Private System</u>.

a) The membership coverage of employer-sponsored pension plans in Canada is on the low side compared with the other seven industrial countries.

b) Compulsory vesting under private plans in Canada is required later than in all of those seven countries. Locking-in of employee contributions is also later in Canada than it is in the five countries which also require it.

c) Post-retirement benefit adjustments under private Canadian pension plans appear to be less common than in most of those countries, but the data is such that it is difficult to be certain.

d) Private plans in Western Europe particularly have shown a more general trend toward final or final average earnings benefit formulae than in Canada.

3. <u>The Combined Public and Private System</u>.

a) Unlike many countries in Europe, no official target has been established in Canada with respect to the amount of retirement income in relation to pre-retirement earnings that should be yielded by the combined public and private retirement income system. While the data are not available to permit quantified comparisons to be made, such evidence as does exist suggests that in aggregate the amount of retirement income generated by the combined public and private system in Canada in relation to pre-retirement earnings is low by comparison with that in a number of other industrial countries.

b) The tax treatment in Canada of contributions to retirement income vehicles and of benefits subsequently paid out is generally in line with the pattern evident in most other industrial countries.

Bibliography

The information contained in this appendix was prepared from legislative sources and from the numerous publications listed below.

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Union Bank of Switzerland, "Social Security in 10 Industrial Nations".

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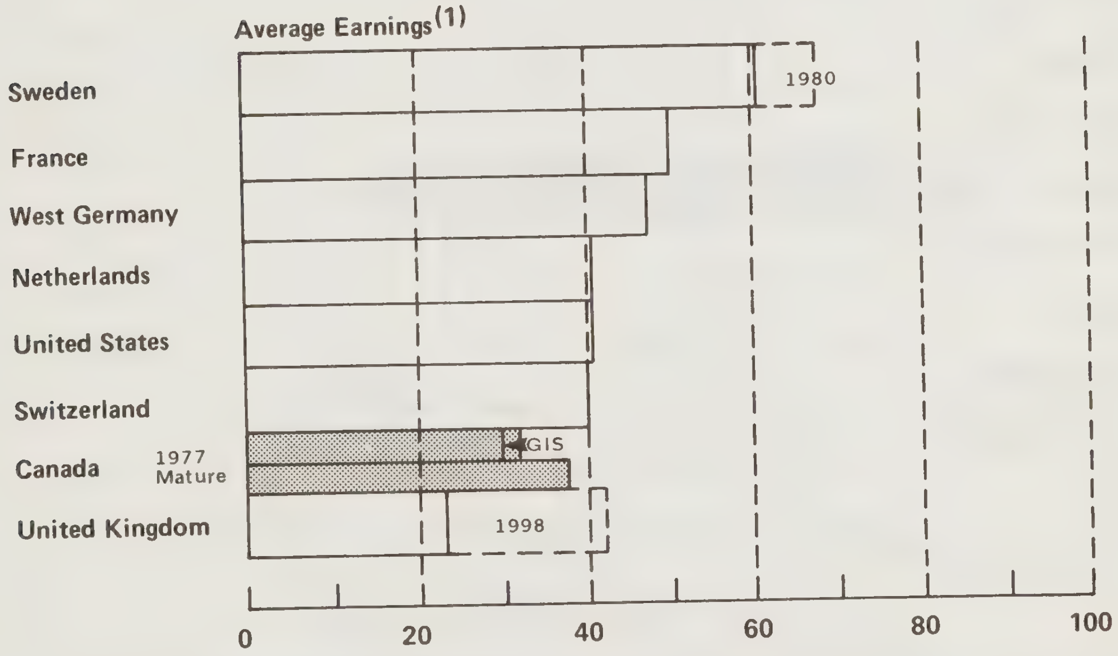
ANNEX TO APPENDIX 2

FIGURE 1

Public Pensions as a Percentage of Gross Earnings Just Before Retirement

Single Persons or Two-Earner Couples with Earnings Present Throughout Work Years

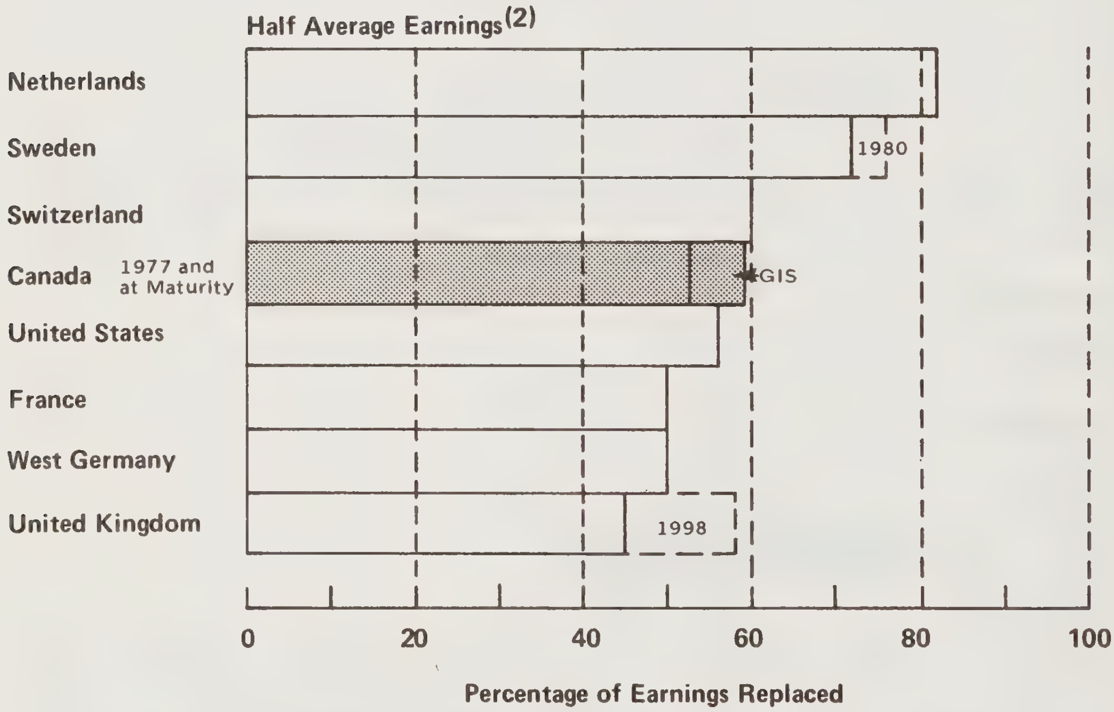


(1) In the case of a two-earner couple, each one receives the average earnings.

FIGURE 2

Public Pensions as a Percentage of Gross Earnings Just Before Retirement

Single Persons or Two-Earner Couples with Earnings Present Throughout Work Years

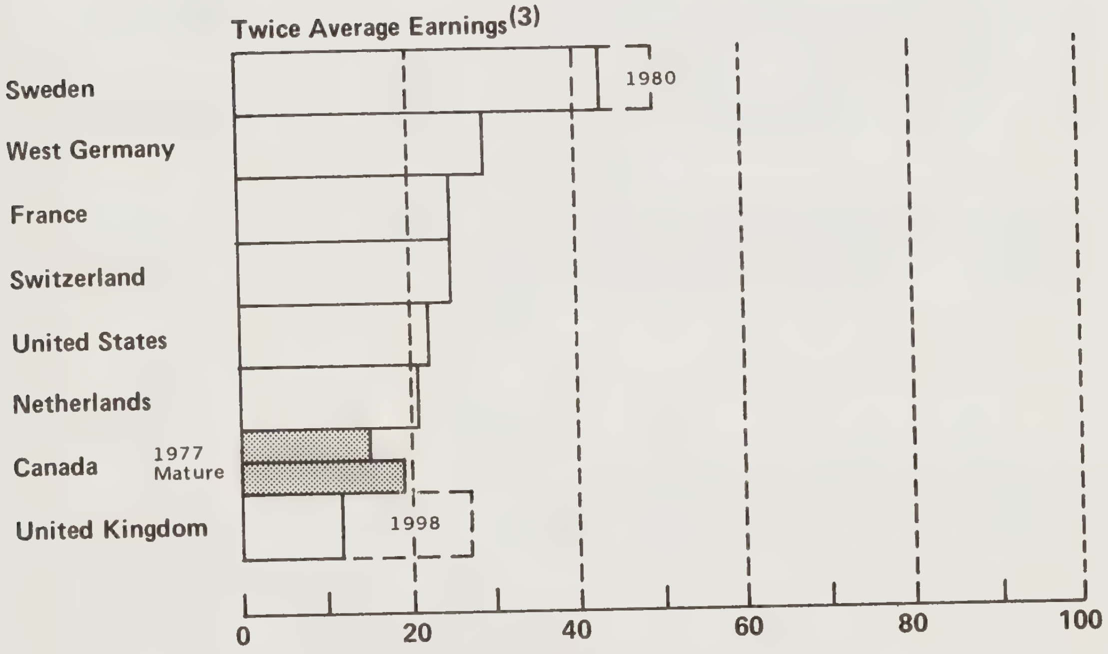


(2) In the case of a two-earner couple, each one receives half average earnings.

FIGURE 3

Public Pensions as a Percentage of Gross Earnings Just Before Retirement

Single Persons or Two-Earner Couples with Earnings Present Throughout Work Years



(3) In the case of two-earner couple, each one receives twice average earnings.

APPENDIX 3

SUMMARY OF QUEBEC REPORT: "LA SECURITE FINANCIERE DES PERSONNES AGEES AU QUEBEC (COFIRENTES)"

The following summary of this report appeared in the May 1978 Bulletin of the Régie des Rentes du Québec.

In its report presented to the Assemblée nationale on March 14 last, the "Comité d'étude sur le financement du Régime de rentes et sur les régimes supplémentaires de rentes" (COFIRENTES +) recommends sweeping reforms which would ensure on a long-term basis the financial soundness of the Régime de rentes and, at the same time, improve the benefits provided under the Plan.

The Committee was set up in February 1976 with a mandate to study all aspects of the financing of the Régime de rentes in the light of its particular nature, to analyse the actuarial reports made since 1966 and to evaluate the respective roles of both public and supplemental plans in providing greater financial security for the elderly.

The report was commented upon in the press, and in special radio broadcasts on public affairs. It was made very clear to the taxpayers that their contributions would have to be raised in the very near future.

Depletion of the Reserve

Indeed, if no change is made to the Plan, benefits paid out will, in the early part of the next decade, exceed contributions and the fund will dry up before the end of the century. The Plan will then start accumulating substantial deficits year after year, primarily because of the declining ratio of active workers to retired people. In fact, it is expected that by the end of the century, the number of retired people could be as much as 35% higher than previously forecast. In order merely to put the Plan on a financially sound basis, assuming no change is made in its present structure, contributions will have to be increased from 3.6% to 4.2% for the next five years; this rate will have to be progressively brought to 6% before year 2000.

The Committee's Viewpoint

However, the Committee, whose report was significantly entitled "La sécurité financière des personnes âgées au Québec" (Financial security for Quebec's elderly), felt that consideration should first be given to the needs of the aged, bearing in mind, of course, the financial resources

available. Thus, of two alternatives - one under which benefits would be tailored to available funds, and the other under which a desirable level of benefits would be assessed and suitable financing methods devised - the Committee recommends the latter.

A survey of the financial needs of Quebec's elderly has revealed that nearly two-thirds of retired people live on incomes below or very near the poverty level, which was established by Statistics Canada at $4,000 for a single person and $6,000 for a couple in 1976. More than 60% of the elderly population in Quebec receive a portion of the Guaranteed Income Supplement (GIS) and, among them, 30% receive the full amount.

The Committee therefore recommends a reform of the present pyramid structure of income-maintenance plans, which, over the years, were created to meet the needs as they grew. At the base of this pyramid is the Old Age Security pension; the remaining layers are formed by the Régime de rentes du Québec, or the Canada Pension Plan, and supplemental pension plans, or the Guaranteed Income Supplement for elderly persons whose income is below a certain minimum.

The Present Situation

The Régime de rentes du Québec covers less than one-third of the 480,000 Quebecers aged 65 or over, principally because of its eligibility requirements and its relatively recent inception. Similarly, the overall coverage under supplemental pension plans extends to only about one-half of the workers and this coverage is concentrated in only a few sectors of economic activity. For instance, coverage is 100% in the construction industry, 92% in public administration, between 39 and 44% in the service sector, whereas it is hardly 10% in the commercial sector and negligible in the farming sector. As for Registered Retirement Savings Plans, they are mostly favoured by workers whose income is high enough to make tax deferments attractive.

Proposed New Structure

In order that all Quebec's elderly people may enjoy a decent standard of living, the Committee recommends that universal non-contributory, state-financed plans (i.e. the Old Age Security pension and the Guaranteed Income Supplement) ensure a yearly income reaching at least the poverty level to all persons aged 65 or over who are without financial means. The contributory public plan, that is the Régime de rentes du Québec, added to Old Age Security benefits, should eliminate the necessity for a Guaranteed Income Supplement. The supplemental pension plans would then play their true role by providing additional retirement income to workers whose pre-retirement earnings were above the minimum wage level, and early retirement benefits to members working in difficult or unhealthy conditions.

The GIS would, therefore, be required only for elderly people who had little or no employment earnings during their active life, and consequently could not be entitled to full benefits under contributory

public plans. It should be remembered that the Guaranteed Income Supplement was meant as a temporary measure pending the coming to maturity of the contributory public plans.

The Old Age Security pension would be maintained in its present structure. The Régime de rentes du Québec, however, would become the basic income-maintenance vehicle for a substantial portion of the working population. Its benefits should be high enough to eliminate the necessity of resorting to the GIS; by the same token, low wage earners would no longer feel obliged to contribute to supplemental pension plans. Furthermore, workers whose pre-retirement income was at the minimum wage level should be ensured a total retirement income equivalent to their previous available income, i.e. to 90% of their employment earnings.

Reform of Benefit Structure

If the Régime de rentes du Québec is to fulfil the role assigned to it, the Committee recommends that its income-maintenance rate, presently 25% of the contributor's average pensionable earnings, be raised to 50% on the first half of the value of the maximum pensionable earnings, and remain at 25% for the second half. Thus, for a worker whose average earnings are at the maximum pensionable earnings level, his retirement pension under the Régime de rentes du Québec would represent 37.5% of this maximum. The Committee recommends that this proposed measure be applied both to present and to future beneficiaries.

With regard to the other benefits available under the Régime de rentes du Québec (disability pensions, pensions for disabled contributors' children, surviving spouse's pensions, orphan's pensions and death benefits) the Committee's recommendations concentrate on the surviving spouse's pension. This pension would be substantially increased, but would be paid only on a temporary basis, during a period of adaptation. It would be progressively reduced after the last child's seventh birthday. The pension amount would be graduated according to the number of dependent children, and the orphan's pension as such would be eliminated. At the end of the adaptation period, the pension would be terminated; if the beneficiary's financial situation warranted, the pension would be replaced by social aid. The new provisions would apply only to surviving spouses who, at the time the reform became effective, were under age 35 and had dependent children. Present provisions would be maintained in the case of surviving spouses aged 35 or over.

Financing of the Benefit Reform

The proposed reform of the benefit structure would necessitate an additional increase of 2.6 points in the contribution rate, which would then become 6.8% for the first five-year period. The employee's contribution would continue to apply only to his pensionable earnings, but the employer's would be calculated on the employee's total salary. The Committee feels that this would result in a more equitable treatment of all businesses operating in Quebec.

The increase of the financial burden of the plan would also be partly offset by a decrease in the need for Guaranteed Income Supplement payments. The government of Quebec could therefore claim from Ottawa the reimbursement of the sums no longer paid to Quebec residents.

The Plan Reserve

The Committee feels that the purpose of the reserve should be to absorb the impact of changes in economic conditions and in the population ratio of workers to retired people, and at the same time to reduce plan costs through revenues derived from investments.

The Committee therefore proposes a method of financing whereby the contribution rate required to cover benefit payments and administration costs would be established over a 25-year period; a reserve would be set up to cover the equivalent of benefits paid and administration costs for the 26th year; an additional reserve would be established to account for discrepancies between income and expenditures resulting from the expected imbalance between the number of beneficiaries and the number of contributors during the period from 2020 to 2045.

In order to maintain the reserve at the desired level, the Committee recommends that the contribution rate considered necessary after each quinquennial valuation be applied automatically.

Supplemental Pension Plans

The Committee feels that participants in supplemental pension plans should be able to count on the retirement income promised by their plan. To this end, the Committee recommends vesting and locking-in of contributions when the employee's age and years of membership in the plan total 35 or more. The management of the deferred pensions so acquired would be entrusted to a central agency administered by the Régie des rentes du Québec.

Furthermore, the Committee recommends that part of the additional revenue on investments attributable to inflation be applied in future to pension increases.

Given the complementary role of supplemental pension plans, the Committee is also of the opinion that under these plans, early, and perhaps temporary, retirement pensions should be provided to employees working in difficult or unhealthy conditions, between the effective date of their retirement and the date on which they become eligible for public plan benefits.

Finally, the Committee recommends that participants have access to any information concerning the financial situation of their pension plans; and that they be represented on a retirement committee.

APPENDIX 4

PENSION PLAN SIMULATION MODEL
DEVELOPMENT OF COST ESTIMATES
MAY 26, 1978

James G. Paterson, F.S.A., F.C.I.A.
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Had more employee data, more time and more budget been available, it would have been useful to perform a number of supplemental calculations employing different data, assumptions, techniques and actuarial funding methods and involving both past service and future service benefits. However, it is not felt that these data shortcomings or shortcomings due to considerations of cost have a significant effect upon the validity of the results arrived at although, where appropriate, comments are contained in the report indicating the other results that might have been obtained had the study examined different basic data.(1)

II. DESCRIPTION OF THE MODEL

Using the input specifications which are described in Section III and a lengthy series of mathematical formulae, the model simulates:

- the growth and/or decline of the employer's workforce and the pension plan membership;
- the age, service and earnings distributions of the employer's workforce and the pension plan membership;
- the contributions made by the plan members;
- the benefits to be paid under the plan in respect of retirement, death, disability and termination of employment;
- the employer contributions required in accordance with the specified actuarial method; and
- the projected assets in the pension fund by year for as many years into the future as there are recipients of benefits under the plan.

While there were a number of pension plan computer models existing in both the private and public domains, this model was developed so that the Task Force had available to it the ability to effectively simulate a number of pension plans simultaneously while reflecting both economic assumptions varying over time and two-dimensional (age and service) decrements or plan entry rates.

1. Length of Simulation. The model simulates the introduction of new entrants to the workforce and plan membership populations for a specified number of years (which can range from zero to 99) after which no new entrants are added and the populations gradually decline and vanish upon the eventual departure of the last active participant.

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(1)Apart from two principal reports which are reproduced in this appendix, the actuarial consultants provided additional data of both a quantitative and explanatory nature, some of which is reflected in the report. The data in Table III-17 of the report, for example, constitute a variation of the data found in Table 6 in the consultant's report of May 1978, which were estimated by the consultant and not based on actual simulation runs.

2. Timing of Events. With one exception, the model assumes that all demographic changes (births, hires, pension plan enrolments, retirements, deaths, disabilities, and terminations of employment) take place on June 30 each year. This simplifies the grouping of data and the determination of cash flows throughout the period of operation of the model. With this simplification, employees are treated as though they are hired, retire, die, become disabled and terminate employment only on an anniversary of their birth at an integral age. The one exception is that pensioners and former employees entitled to deferred pensions are not assumed to die on June 30, but rather deaths are assumed to take place twice during a year, on March 31 and September 30. This introduces a little extra accuracy in handling indexed pensions and deferred pensions as any indexing adjustments are assumed to take place on January 1 each year.

All economic changes in a year (changes in the rate of investment return, rate of average wage and salary (AWS) increase, rate of increase in average prices, rate of increase in the Yearly Maximum Pensionable Earnings (YMPE) and pay adjustments due to merit, promotion and seniority) are assumed to take effect on January 1.

3. Events Being Simulated. The model simulates one population increment (new entrants) and four 'initial' decrements (retirement, death while in active employment, disability and termination of employment) for both the workforce and plan membership populations, and one 'secondary' decrement (death after retirement) for the plan membership population.

Upon the occurrence of a decrement, a cash benefit payment or a series of benefit payments is paid as determined by the provisions of the plan.

At present, the model does not simulate secondary decrements (death or recovery after disability), but does develop a year-by-year cash flow projection for pensions in payment or deferred pensions, thereby incorporating post-retirement and post-termination mortality.

4. Actuarial Methodology. In determining the employer contributions, the model does not employ the traditional 'commutation functions', but rather develops the present values of future benefits and of future employee contributions by discounting for interest only (at the assumed rate of investment return) the year-by-year projected benefit payments and employee contributions. The level of employer contributions is then determined based on the actuarial method specified.

At present the model handles only the attained age normal and 'aggregate' actuarial methods. Minor modifications enable a rough 'unit credit' costing to be done at specified intervals.

5. Computer Specifications. The program has been written in VS APL (version of APL) for use on an IBM 370 having OS MVS operating system with TSO (time-sharing). It uses up to 3 million bytes of virtual memory and takes from five to ten minutes (five to twenty minutes on IBM 370-168) of central processor unit time to run, depending on the number of plans and the number of economic scenarios being simulated simultaneously.

It was developed first for use on IBM service bureau equipment but has subsequently been successfully converted and run by other service bureaus (CSG, Datacrown).

The program contains an interactive menu system for easy, fast selection and insertion of the input specifications (data, actuarial assumptions and technical description of plan provisions) and choice of output detail. It can be initiated from any remote terminal containing an APL keyset.

A sample input specification summary sheet as well as some sample output sheets are contained in Annex B.

III. INPUT SPECIFICATIONS USED FOR TASK FORCE SIMULATION RUNS

The model requires three forms of input specifications for each simulation run. These are the initial employee census data, the actuarial (economic and demographic) assumptions and the technical description of the terms and provisions of the plans to be simulated.

A. Initial Employee Census Data

The initial distributions of employees and plan members by sex, age, service, earnings level and employee classification were developed from December 31, 1975 data contributed by a large (more than 10,000 employees) employer with operations in several industries, from coast to coast. Some 58% of this employer's workforce were covered by one of the company's two voluntary, contributory pension plans.

The January 1, 1978 workforce and plan membership distributions were developed from the December 31, 1975 data by adjusting the wages and salaries to reflect changes in AWS in Canada (the Industrial Composite) during the intervening three years.

Tables 1 to 3 of this report, on the following pages, summarize the initial census data used for the Task Force simulations.

B. Actuarial Assumptions

The model entails the use of a lengthy list of actuarial assumptions. These can generally be classified into two categories - economic assumptions and demographic assumptions.

1. Economic Assumptions. The economic assumptions chosen for the simulation runs represent a general consensus of the opinions of a number of actuaries and economists involved with the Task Force. These assumptions reflect current experience in the short term and a return to a more traditional economic environment in the long term. The more important economic assumptions employed for the main body of simulation runs are set out below.

Annual Rate of	1978 to 1980	1981 to 1984	1985 to 1989	1990 to later
		(%)		
Return on pension fund assets	8.5	7.5	7.0	6.5
Increase in average wages	9.0	7.0	6.0	5.0
Increase in prices	7.25	5.0	4.0	3.0
Increase in YMPE	12.5	12.5	(1)	5.0

(1)12.5% for 1985, 6.0% to 1989.

Table 1

Representative Employer Data

	Active Employees					
	Number of Employees	Estimated Annual 1975 Earnings	Average Age	Average Service	Average 1975 Annual Earnings	Female
	nearest 100	$			$	%
Pension plan members						
Hourly	6,900	70,000,000	45.6	18.9	10,200	5.6
Salaried	3,000	47,000,000	45.9	17.8	15,600	13.3
Non-members						
Hourly	5,800	45,000,000	31.0	4.1	7,700	9.0
Salaried	1,500	13,000,000	29.6	2.9	8,900	41.7
All active employees						
Hourly	12,700	115,000,000	38.9	12.1	9,000	7.2
Salaried	4,500	60,000,000	40.6	12.9	13,400	22.8
Total	17,200	175,000,000	39.3	12.3	10,200	11.2

Table 2

Summary of Active Employees as at January 1, 1978 for Simulation Runs

	Ages	Years of Service 0-9	10-19	20-29	30-39	40-49	total	Number of Plan Members
Number of lives		232.19					232.19	32.54
Average age	18-27	22.93					22.93	
Average service		2.23					2.23	
Average 1978 salary		$14,539					$14,539	
Number of lives		156.70	76.18				232.89	106.06
Average age	28-37	30.91	32.91				31.56	
Average service		3.83	12.06				6.52	
Average 1978 salary		$16,978	$17,381				$17,110	
Number of lives		63.97	62.33	73.25			199.55	149.26
Average age	38-47	41.67	41.56	43.08			42.15	
Average service		4.02	13.67	22.57			13.85	
Average 1978 salary		$18,164	$18,161	$18,175			$18,167	
Number of lives		36.46	45.31	84.21	59.02		225.01	193.53
Average age	48-57	51.44	51.49	51.82	52.58		51.89	
Average service		4.22	13.93	24.35	32.07		21.02	
Average 1978 salary		$17,795	$17,792	$17,766	$17,711		$17,761	

Table 2 (Cont'd)

Ages		Years of Service						Number of Plan Members
		0-9	10-19	20-29	30-39	40-49	total	
Number of lives		10.29	15.41	38.37	34.05	12.25	110.37	98.61
Average age	58-65	60.20	60.31	60.39	60.26	60.96	60.38	
Average service		4.69	14.09	24.45	32.99	41.61	25.70	
Average 1978 salary		$17,066	$17,057	$17,048	$17,060	$16,992	$17,048	
Total lives		499.60	199.24	195.83	93.08	12.25	1,000.00	580.00
Average age		30.68	41.93	50.19	55.35	60.96	39.39	
Average service		3.16	13.14	23.70	32.40	41.61	12.34	
Average 1978 salary		$16,057	$17,695	$17,781	$17,467	$16,992	$16,863	

Table 3

Summary of Inactive Life Data as at January 1, 1978 for Simulation Runs(1)

Retired employees

Number of lives	160
Average age	68.87
Average period since retirement	5.35
Average annual pension	$3,297

Deferred vested pensions

Number of lives	50
Average age	54.60
Average years to retirement	10.40
Average annual pension	$7.95

(1)For use in those simulation runs involving accrued or past service benefits.

As noted in Section IV, sensitivity tests were conducted using a number of different sets of economic assumptions.

2. Demographic Assumptions. The demographic assumptions consist of several tables of numerical data representing:

- annual rates of increase in wages and salary due to merit, promotion and seniority;

- distributions of new employees by age and salary and of new plan members by age, service and salary;

- annual probabilities of decrement from active employment and active plan membership by death, termination, disability or retirement;

- proportions of plan members married by age; and

- average age differences between spouses.

These tables are contained in Annex A of this report.

The principal source of this data was the data tape contributed by a large private sector employer containing detailed historical information on the same workforce and plan membership group which were used for the initial employee census data. The tape contained relatively complete census data and decrement data covering the period from January 1971 to December 1975 and historical salary data as far back as 1962. These data were analyzed in detail and were the subject of a report dated September 9, 1977.

Other sources of data included:

- the 1971 Group Annuity Mortality Tables;

- the experience of and the assumptions used for the Public Service Superannuation Act (PSSA);

- the experience data gathered by the Commission of Inquiry into Railway Pensions;

- several contributions of private sector experience data submitted by actuaries as a result of a request to the Canadian Institute of Actuaries; and

- some total population studies conducted by American and Canadian government agencies.

The 'other' sources of data were used as the primary source for the assumed probabilities of retirement, death and disability. The data from the contributing employer were the primary source for the balance of the demographic assumptions. In developing the tables in Appendix A from these data the crude data were 'smoothed' by the use of regression

techniques and then compared with such other comparable data as were available. After conducting these comparisons, adjustments were made to the smoothed tables where it was considered appropriate to do so.

Although separate tables for salaried and hourly employees, males and females, were derived for most of the experience data, composite data tables were prepared to reduce the operating cost of the simulation runs. These composite tables contain the weighted averages of the data contained in the separate male and female, hourly and salaried employee data tables. As an example, if 15% of the plan members in a given age/service unit were female hourly employees, the data in the 'female hourly' tables would be given a 15% weighting in developing the composite tables.

In addition to the tables contained in Appendix A, additional inputs for each simulation run were sets of annuity value tables corresponding to the economic assumptions (and mortality assumptions) being used for that run. In the interests of brevity, these tables are not included in this report but were supplied to the Task Force in the Third Book of Supplements to the Operating Instructions for Task Force Simulations, prepared in December 1977.

C. Terms and Provisions of the Plans

To illustrate the order of magnitude and the degree of variation in pension costs, pension cost estimates have been developed as at January 1, 1978 for five 'benchmark' pension plans which are generally representative of the pension plans covering private sector employees, according to 1974 data published by Statistics Canada. The five benchmark plans are as follows:

Plan 1: 5% Money Purchase - employees contribute 3 1/2% of earnings up to the YMPE plus 5% of earnings in excess of the YMPE. The employer contributes a matching amount, subject to the vesting rules.

Plan 2: $10.00 Flat Benefit - pension of $10.00 per month per year of service (non-contributory).

Plan 3: 2% Career Average - pension of 1.4% of each year's earnings up to the YMPE plus 2% of each year's earnings in excess of the YMPE (contributory).

Plan 4: 1 1/2% Final Earnings - pension of 1% of final average earnings up to the YMPE plus 1 1/2% of final average earnings in excess of the YMPE (contributory).

Plan 5: 2% Final Earnings - pension of 1.4% of final average earnings up to the YMPE plus 2% of final average earnings in excess of the YMPE. Maximum 35 years (contributory).

In addition, these plans share a number of common characteristics as follows:

Eligibility - all employees eligible.

Service - all service eligible for credit under the plans, subject to maximum number of years in some cases.

Earnings - all earnings eligible for credit under the plans, with no limits.

Employee Contributions - 3 1/2% of earnings up to the YMPE, plus 5% of earnings in excess of the YMPE, subject to an annual maximum of $3,500, indexed to the Consumer Price Index (CPI). Only the $10.00 flat benefit plan is non-contributory.

Normal Retirement Age - 65 on all plans.

Early Retirement Benefit - a reduction in the accrued pension of 5% for each year prior to age 65.

Pre-Retirement Death Benefit - refund of contributions with interest. Interest to be credited each year at a rate of 2% below the rate of return on the pension fund assets.

Disability Benefit - same as termination of employment prior to 'vesting' date. Upon occurrence of a long-term disability, the disabled member is treated in the same manner as for termination of employment.

Normal Form of Pension - single life pension payable for life, with a guaranteed minimum of five years' payments in any event.

Maximum Retirement Benefit - years of service multiplied by $1,715, indexed to the CPI.

Termination of Employment - no vesting until the attainment of age 45 and completion of 10 years of service. Vesting is 100% after age 45 and 10 years of service. 'Locked-in' deferred pensions are subject to a minimum value equal to the employee's contributions with interest.

Final Average Earnings - computed as the average annual earnings in the employee's best five years.

In addition, a number of simulation runs were conducted incorporating changes from these terms and provisions in order to measure the cost impact of the changes on each of the benchmark plans.

IV. RESULTS OF THE SIMULATION RUNS

All of the cost estimates which follow are expressed as a percentage of covered payroll. The corresponding percentage of total payroll would, of course, be lower if there were less than 100% participation among the employee group.

A. Basic Costs for Benchmark Plans

The estimated costs for current service benefit accruals under the benchmark plans described in Section III are shown in Table 4.

Table 4

Basic Results for Benchmark Plans. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plans (Not Indexed)					Indexed
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average	2% Final Average
			(%)			
Initial results	3.24	1.01	2.05	2.08	3.96	6.01

Notes:
1. See Section III for a detailed description of the plans and of the underlying data, assumptions and methods.
2. With the exception of the non-contributory flat benefit plan, the employee contributions under each of the plans would amount to approximately 4.0% of covered payroll.
3. Both the employer and employee contributions exclude Canada Pension Plan (CPP) contributions. It should be noted that the CPP contribution rate can be expected to increase in future, even without benefit improvements.
4. The two columns on the far right-hand side of the table represent the same plan design except that the plan described in the final column is indexed fully to the CPI.

It should be noted that the costs would have differed somewhat had the demographic assumptions been those for a salaried group or an hourly group, rather than those for a mixed group. Furthermore, certain employers and certain industries may experience extreme rates of turnover, disability or early or late retirement resulting in markedly different costs than those shown. The effects of variations in rates of turnover and retirement are reviewed later in this report, as are the effects of variations in the employee group involved.

If any of these plans were less than fully funded at January 1, 1978 (i.e. if the accrued liabilities for service rendered prior to 1978 exceeded the pension fund assets at January 1, 1978), there would be additional costs required to amortize the unfunded liabilities. These unfunded liabilities are normally amortized by uniform annual dollar payments over a fixed period of years, although some variations exist. A series of uniform annual dollar payments is actually a series of decreasing 'percentage of covered payroll' payments, if the covered payroll of the employee group is on the increase, and vice versa.

B. Impact of Variations in Actuarial Factors

The pension cost estimates presented so far have been based on employee census data from a single, large group of employees and on an actuarial method and a series of economic and demographic assumptions which have been carefully developed to produce realistic and reasonable cost estimates from today's perspective. In the final analysis, however, it will be the actual experience of the plans and not the assumed experience which will determine the real costs.

1. Variations in Employee Data. To test the impact of a change in the age, services and earnings composition of the employee group, comparative cost estimates were prepared for a younger group of plan members, an older group of plan members, a group comprised only of salaried employees and a group comprised only of hourly employees.

A more extreme change in employee data, (in combination with higher employee termination rates) was also tested. For this purpose the census data of employees who are not members of the sample employer's pension plan were used.

A comparison of the original group and the comparison groups follows:

	Proportion of Employees in Plan	Average Age of Members	Average Years of Service of Members	Average 1978 Earnings of Members	Female Proportion of Members
	%			$	%
Original group	58	45.7	18.6	17,500	8
Younger group	58	41.7	14.7	17,400	8
Older group	58	47.7	20.6	17,600	8
Hourly group	54	45.6	18.9	16,100	5
Salaried group	67	45.9	17.8	20,100	13
Non-member group	0	30.7	3.9	11,800	16

The estimated costs and the percentage change in costs arising from this change are shown in Table 5.

Table 5

Variation in Age and Service Compositions. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plans (Not Indexed)					Indexed
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average	2% Final Average
			(%)			
Initial employee group	3.24	1.01	2.05	2.08	3.96	6.01
Younger group	3.16	0.90	1.76	1.94	3.76	-
(% increase over line 1)	(-2.5)	(-10.9)	(-14.1)	(-6.7)	(-5.1)	-
Older group	3.29	1.07	2.25	2.18	4.11	6.15
(% increase over line 1)	(+1.5)	(+5.9)	(+9.8)	(+4.8)	(+3.8)	(+2.3)
Hourly group	3.20	-	1.81	-	3.94	-
(% increase over line 1)	(-1.2)	-	(-11.7)	-	(-0.5)	-
Salaried group	3.42	-	2.47	-	4.04	-
(% increase over line 1)	(+5.6)	-	(+20.5)	-	(+2.0)	-
Non-member group	-	-	-	-	1.3	3.0
(% increase over line 1)	-	-	-	-	(-67)	(-50)

Notes:
1. See the Notes to Table 4. All of them apply here as well.
2. To reduce the number of computer runs required, cost estimates for these variations have not been prepared for all plans.
3. Composite demographic assumptions were used for the first three groups shown above. Hourly demographic assumptions and salaried demographic assumptions, respectively, were used for the hourly and salaried groups. Significantly higher termination rates were used for the non-member group.
4. The figures shown for the non-member data have been calculated on a more approximate basis than the other figures shown, with the use of a simpler simulation model than the model used to calculate the other figures.

With the exception of the results for the non-member group, the impact of these changes in age and service composition is significant, but not as dramatic as the effect of some of the other factors being examined. It is useful to note the ranking of the relative impacts (career average, flat benefit and final average, in that order). Had the flat benefit plan been contributory, it would have ranked ahead of the career average plan in relative impact.

2. Variations in Economic Assumptions. Four tests of the impact of deviations in the economic assumptions on pension cost estimates were conducted. These were as follows:

	Annual Rate of	1978 to 1980	1981 to 1984	1985 to 1989	('Ultimate') 1990 and Later
				(%)	
Original assumptions	return on assets	8.5	7.5	7.0	6.5
	average wage increase	9.0	7.0	6.0	5.0
	price increase	7.25	5.0	4.0	3.0
Test #1: lower wage increases ('ultimately' by 1/2% per annum)	return on assets	-------- same as original ------------			
	average wage increase	9.0	6.75	5.5	4.5
	price increase	------- same as original ---------			
Test #2: lower return on assets ('ultimately' by 1/2% per annum)	return on assets	8.5	7.25	6.5	6.0
	average wage increase	-------- same as original ----------			
	price increase	-------- same as original ----------			
Test #3: lower wage increases and return on assets	return on assets	8.5	7.25	6.5	6.0
	average wage increase	9.0	6.75	5.5	4.5
	price increase	-------- same as original ----------			
Test #4: higher wage and price increases, and higher return on assets	return on assets	8.5	8.5	8.5	8.5
	average wage increase	9.0	8.0	7.5	7.0
	price increase	7.25	6.25	5.5	5.0

The estimated costs and the percentage change in costs arising from these variations in economic assumptions are shown in Table 6.

Table 6

Variation in Economic Assumptions. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plans (Not Indexed)					Indexed
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average	2% Final Average
			(%)			
Initial assumptions	3.24	1.01	2.05	2.08	3.96	6.01
Lower wage increases	-	-	-	1.87	3.67	-
(% increase over line 1)	-	-	-	(-10)	(-7)	-
Lower return on assets	-	-	2.46	-	4.62	-
(% increase over line 1)	-	-	(+20)	-	(+17)	-
Lower wage increases and return on assets	-	1.12	2.41	-	4.28	6.64
(% increase over line 1)	-	(+11)	(+18)	-	(+8)	(+10)
Higher wage and price increases and return on assets	-	0.70	0.92	-	2.90	-
(% increase over line 1)	-	(-31)	(-55)	-	(-27)	-

Notes:
1. See the Notes to Table 4. All of them apply here as well.
2. To reduce the number of computer runs required, cost estimates for these variations have not been prepared for all plans.

A given change in the interest rate has a greater impact on employer costs than the same amount of change in the other economic factors tested. This is a reasonable conclusion, since the interest rate impacts strongly on all plans, in both the pre-retirement and post-retirement periods. Wage increases and price increases impact only on certain types of plans, the former only during the pre-retirement period and the latter only during the post-retirement period.

In the examples shown, the employer cost is most sensitive to permanent, long-term changes in economic assumptions in the case of career average plans. Next come flat benefit plans, and finally final average plans.

The foregoing tests of economic assumptions provide a variety of cost estimates which are based on maintaining productivity increases per employed worker (average wage increase minus price increase) in the range of 1.5-2% per annum over the long term, a return to real long-term rates of return (return on assets minus price increase) of 3-3.5% per annum by 1990 and a return to long-term inflation ranging from 3-5% per annum. Because of the long phase-in period (up to 1990) for these variations in economic assumptions, their cost impact is less than if the variations were to take full effect immediately. While the foregoing may be a reasonable range of assumptions for purposes of estimating the trend of pension costs over the very long term (20-50 years) it ignores the volatility of these costs over shorter periods. This subject will be discussed further, later in this section.

3. Variations in Demographic Assumptions. We conducted a number of tests to determine the impact on plan costs of changes in certain demographic assumptions. These tests included:

- retirement rates increased by one-half of the original rates at ages under 65;

- retirement rates reduced by one-quarter of the original rates at ages under 65;

- termination of employment rates increased by one-half of the original rates at all ages and years of service;

- termination of employment rates reduced by one-half of the original rates at all ages and years of service; and

- rates of entry into the plan increased by one-half of the original rates at all ages and years of service (subject to a maximum rate of 100% at any age and length of service).

Table 7 illustrates the differences from the original cost estimates which these variations in assumed demographic assumptions generated. While greater deviations from the original demographic assumptions and deviations in other demographic factors may produce more significant differences in costs than did the foregoing tests, it is clear that in most cases deviations in economic assumptions will have greater impact on pension costs than deviations in demographic assumptions. It is likely, however, that a deviation in the demographic assumptions will have a greater effect on a younger population.

Table 7

Variation in Assumed Demographic Rates. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	5% Money Purchase	2% Career Average (%)	2% Final Average
Original assumptions	3.24	2.05	3.96
Higher retirement rates	N/A	2.02	3.93
Lower retirement rates	N/A	2.05	3.98
Higher termination rates	3.18	2.19	3.90
Lower termination rates	3.24	2.05	3.98
Higher entry rates	3.21	1.95	3.87

In order to test the impact of a more extreme change in demographic factors, supplemental calculations were performed using as employee data the census data of employees who were not members of the sample employer's pension plan (see Table 1 for details). For these calculations, relatively high employee termination rates (i.e. those experienced among the non-members) were used (see page 4-A-7). The younger non-member data together with the higher termination rates produced an employer cost for the 2% final average plan of approximately 1.3% of covered payroll, as compared to 3.96% of covered payroll using the plan member data and termination rates. This is equivalent to 33% of the 3.96% rate.

4. Variations in Actuarial Methods. Most private sector actuarial valuations employ 'closed group' calculations projecting benefit accruals over the working lifetime of the current employee group. With closed group calculations, no provision is made for future replacements in the group as the current employees retire, die, become disabled or terminate their employment. All of the illustrations presented here, except for Table 9 (Volatility of Economic Factors) are based on closed group calculations. Table 9 employs the 'open group' technique, with the continual addition of new entrants to the employee group, in accordance with assumptions as to the rate of entry and earnings level which are detailed in Annex A.

The simulation model permits two distinct types of closed group calculations. These are:

- the 'closed workforce' type in which the model admits no new employees into the employer's workforce after the valuation date, but employees who are not then plan members continue to enroll in the plan after the valuation date in accordance with the assumed plan entry probability distribution; and

- the 'closed membership' type in which the model admits no new entrants to the plan after the valuation date.

The closed group results presented in this report are all of the closed workforce type. Virtually all private sector actuarial valuations have traditionally been done on the closed membership basis, although there has been some tendency in recent years to perform open group type cash flow projections for very large plans.

The following table demonstrates the results on the three different bases.

Table 8

Comparison of Open and Closed Group Techniques.
Estimated Employer Pension Costs for Current Service
% of Covered Payroll

	Benchmark Plans (Not Indexed)		
Group Technique	5% Money Purchase	2% Career Average	2% Final Average
		(%)	
Open group	2.6	0.8	2.8
Closed workforce (% increase over line 1)	3.2 (+23)	2.1 (+160)	4.0 (+43)
Closed membership (% increase over line 1)	3.5 (+35)	2.5 (+213)	4.4 (+57)

In theory, the open group type should give the most reasonable results, as long as the new entrant assumptions are appropriate. However, the foregoing open group results are based on only one set of assumptions concerning the rate and distribution of new entrants. It is impossible to assess the reasonableness of these results without further technical analysis of the new entrant assumptions and the development of further open group runs with varying new entrant assumptions.

There are a number of actuarial methods used to determine pension costs. Some produce 'percentage of payroll' costs which increase over the long term, while others produce level, or even decreasing long-term costs. All of the acceptable methods require sufficient funds to be contributed over the life of the plan, but the amount of the contributions required at any point in time varies from one method to another. The three most common actuarial methods in use in Canada are the attained age normal, entry age normal and unit credit methods. The first two methods are 'projected benefit' methods. They require that a projection be made of each employee's benefits for future or total service, respectively, under the plan. They then apportion the estimated cost of the projected benefits over the employee's remaining years of service or total years of service, respectively. The unit credit method simply determines the cost of the current year's benefits accrual.

Most of the cost estimates presented here have been calculated on the attained age normal actuarial method. Cost estimates have not been prepared on a variety of actuarial methods.

C. Impact of Volatility of Economic Factors

Even if the economic assumptions used for a pension plan simulation should prove to be accurate over the very long term, the actual experience of a pension plan may differ markedly from the assumptions, particularly for short-term and medium-term periods. As a result, periodic surpluses, deficits and fluctuations in costs will develop over time.

To illustrate the possible magnitude of the fluctuations, cost estimates have been developed assuming that the actual future experience departs sharply but temporarily from the original assumptions. It has been assumed that for the six-year period from 1984-1989, actual increases in prices and in average wages exceed the originally assumed rates by 5% per annum while the actual rates of return on pension fund assets are 1 1/2% per annum below the originally assumed rates. We further assume that the originally assumed rates (6 1/2% investment return, 5% average wage increase, 3% average price increase) are again realized starting with 1990 and that at some date after the year 2005, an offsetting favourable economic deviation occurs so that the economic assumptions are in fact realized on average over the very long term.

For this illustration, we have started with initial employer pension costs based on static long-term economic assumptions of 6 1/2% investment return, 5% average wage increase and 3% average price increase (all compounding annually). This differs from the economic assumptions used earlier in that only the ultimate rates of return and increase (i.e. the ones which were assumed to prevail in 1990 and subsequent years) are now being used for all years starting with 1978. In addition, the open group calculation technique has been substituted for the previous closed group one. For this illustration, assets are valued at market values.

These estimates are based on fully mature and fully funded plans. That is, the calculations assume that the benefit formula and employee contribution rate for each plan have been in effect for several decades and that the assets on hand at January 1, 1978 exactly match the accrued liabilities as of that date. The results of this illustration showing the effect of both a 5-year and a 15-year period to amortize the experience deficiencies for three types of plans, are shown in Table 9.

Table 9

Volatility of Economic Factors. Estimated Employer Pension Costs

	5-Year Amortization			15-Year Amortization		
	Benchmark Plans (Not Indexed)		Indexed	Benchmark Plans (Not Indexed)		Indexed
	2%		2%	2%		2%
	Career Average	Final Average	Final Average	Career Average	Final Average	Final Average
Part 1 - Percent of covered payroll						
Initial employer contribution rate	0.86	2.61	4.53	0.86	2.61	4.53
Actual costs 1978-1986	0.86	2.61	4.53	0.86	2.61	4.53
1987	1.41	7.99	11.15	1.10	4.99	7.46
1988	1.35	7.40	10.43	1.08	4.73	7.14
1989	1.30	6.90	9.81	1.05	4.51	6.86
1990	1.83	12.13	16.22	1.29	6.82	9.70
1991	1.77	11.55	15.50	1.26	6.56	9.38
1992	1.35	7.45	10.47	1.24	6.32	9.08
1993	1.32	7.16	10.11	1.21	6.10	8.81
1994	1.29	6.88	9.77	1.19	5.88	8.55
1995	0.86	2.61	4.53	1.17	5.69	8.30
1996	0.86	2.61	4.53	1.15	5.50	8.08
1997	0.86	2.61	4.53	1.14	5.33	7.86
1998	0.86	2.61	4.53	1.12	5.16	7.66
1999	0.86	2.61	4.53	1.11	5.02	7.48
2000	0.86	2.61	4.53	1.09	4.89	7.32
2001	0.86	2.61	4.53	1.07	4.76	7.16
2002	0.86	2.61	4.53	0.98	3.78	5.97
2003	0.86	2.61	4.53	0.97	3.72	5.89
2004	0.86	2.61	4.53	0.97	3.66	5.82
2005 and later	0.86	2.61	4.53	0.86	2.61	4.53
Part 2 - Percent increase over initial employer contribution rate						
% Increase over line 1 1978-1985	0	0	0	0	0	0
1986	0	0	0	0	0	0
1987	64	206	146	28	91	65
1988	57	184	130	26	81	58
1989	51	164	117	22	73	51
1990	113	365	258	50	161	114

Table 9 (Cont'd)

	5-Year Amortization			15-Year Amortization		
	Benchmark Plans (Not Indexed)		Indexed	Benchmark Plans (Not Indexed)		Indexed
	2%		2%	2%		2%
	Career Average	Final Average	Final Average	Career Average	Final Average	Final Average
1991	106	333	242	47	151	107
1992	57	185	131	44	142	100
1993	53	174	123	41	134	94
1994	50	164	116	35	125	89
1995	0	0	0	36	118	83
1996	0	0	0	34	111	78
1997	0	0	0	33	104	74
1998	0	0	0	30	98	69
1999	0	0	0	29	92	65
2000	0	0	0	27	87	62
2001	0	0	0	24	82	58
2002	0	0	0	14	45	32
2003	0	0	0	13	43	30
2004	0	0	0	13	40	28
2005 and later	0	0	0	0	0	0

Notes:
1. This illustration assumes that actuarial valuations are conducted at the beginning of 1978 and triennially thereafter.
2. The level dollar amortization schedule results in a decreasing percentage of payroll amortization costs.
3. The money purchase plan, by definition, is always fully funded and therefore never requires amortization of unfunded liabilities. It was therefore excluded from this table.
4. The figures in this table (including line 1) have been derived by open group calculations.

In this illustration, the peak contribution rates rise sharply in 1987, decline slightly in 1988 and 1989, then climb to a peak level in 1990 before declining again. This arises because the 1990 valuation discloses a new experience deficiency before the 1987 experience deficiency is fully amortized. Thus, there is an overlap period during which both deficiencies are being amortized.

In the five-year amortization case, the peak employer cost in 1990 represents an increase of 0.97%, 9.52% and 11.69% of covered payroll and an increase of 113%, 365% and 258% over the initial employer contribution rates for the 2% career average, 2% final average and 2% final average indexed plans, respectively. In the 15-year amortization case, the corresponding peak figures are an increase of 0.43%, 4.21% and 5.17% of covered payroll and an increase of 50%, 161% and 114% over the initial employer contribution rates.

The percentage increases over the initial employer contribution rates for the indexed final earnings pension plan are lower than for the non-indexed final earnings plan, because the percentage increase applies on a much larger initial employer contribution rate in the case of the indexed plan. The percentage increase over the initial total (employee and employer) contribution rate and the absolute increase in employer percentage of payroll costs are both higher in the case of the indexed plan.

The illustrations in Table 9 are based on only one set of assumptions concerning the rate and distribution of new entrants. Further technical work on these assumptions and on the use of the open group technique may well improve the reliability of these illustrations. Furthermore, the simulated departures from the assumed 'normal' long-term economic experience are relatively extreme in the historical context (but not too dissimilar from the actual departures experienced over the last five or six years). Nevertheless, there is no doubt that it is possible to have fluctuations of an alarming magnitude in the employer costs for the three plans shown in Table 9.

On the other hand, there are a number of additional factors which indicate that the foregoing illustration comes close to representing the extreme case. The more important factors which would act to reduce the volatility of employer pension costs below the levels illustrated are:

- more conservative initial rates of employer contributions (e.g. consciously adopting smaller margins between investment returns and wage/price increases, and purposely assuming lower than expected rates of employee turnover);

- less mature plans, including plans in which the present benefit formula applies only to current and future service and a less generous or less volatile formula applies to past service;

- the use of smoother asset valuation techniques such as moving averages or trend lines of market values, or discounted cash flow valuation of anticipated future income and return of capital;

- less than fully funded status at January 1, 1978 (i.e. had the plans been less funded, there would have been the need to be amortizing the unfunded liabilities as at January 1, 1978 with consequent higher 'initial employer pension costs'. The subsequent fluctuations would have represented smaller percentage increases over these higher initial costs); and

- use of level or decreasing cost actuarial methods where employee groups are still maturing (aging).

In fact, some or all of these factors are found to exist in respect of most private sector pension plans today.

Furthermore, it should be noted that non-contributory plans would experience smaller percentage increases than contributory plans, and longer amortization periods for experience deficiencies help to dampen the fluctuations in cost. Even with a 15-year 'constant dollar' amortization schedule, however, economic disturbances of the magnitude illustrated appear to create very large, and perhaps to many employers intolerable cost burdens for several years.

These results indicate that further technical work should be conducted on ways to reduce the potential fluctuations in pension costs. Potential areas for study might include:

- the establishment of appropriate levels of 'reserves' for unexpected fluctuations in both asset and liability values;

- the consistent use of 'longer-term' perspectives, which may not recognize the full impact of past or current deviations from long-term economic expectations when valuing pension assets and liabilities, rather than current value techniques; and

- possible changes in the funding rules under pension benefits standards legislation to permit the amortization of surpluses or deficits over longer time periods and in a manner which produces a more level percentage of payroll costs.

Advantages arising from any such procedures would, of course, have to be weighed against possible disadvantages relating to the potential weakening of benefit security.

D. Cost Effects of Variations in Plan Provisions

To illustrate the impact on plan costs of variations in plan design, six possibilities have been selected out of a large number of design alternatives. These are:

1) Improvements in Vesting Provisions

2) Indexing of Retirement Pensions

3) Improvement in Vesting together with Indexing of Retirement Pensions

4) Introduction of a 2/3 Survivorship Pension

5) Changing the Age of Entitlement to Full Pension to 60

6) Improving Coverage by Requiring Compulsory Membership.

These changes are examined in order in the following paragraphs.

1) Improvements in Vesting Provisions. Table 10 illustrates the cost impact of improving the vesting provisions of the original benchmark plans so that ten years' service, without an age requirement, or alternatively two years' service, without an age requirement, would qualify the employee for full vesting. The improved vesting would be on a 'locked-in' basis whereby the employee would not receive a refund of his own contributions. Each employee would be assured of obtaining a benefit at retirement, at least equal in value to his own contributions with interest. There would be no other changes from the original plans.

Table 10

Variation of Vesting Provisions. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plans (Not Indexed)				
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average
			(%)		
Initial plans (age 45 and 10 years' service vesting)	3.24	1.01	2.05	2.08	3.96
10 years' service vesting	-	1.02	2.03	2.07	3.95
(% increase over line 1)	-	(+1)	(-1)	(0)	(0)
2 years' service vesting	3.59	1.05	2.03	2.07	3.95
(% increase over line 1)	(+11)	(+4)	(-1)	(0)	(0)

Notes:
1. See the Notes to Table 4. The first three apply here as well.
2. To reduce the number of computer runs required, cost estimates for these variations have not been prepared for all plans.
3. The estimated employer cost for the money purchase plan with full and immediate vesting is 4.0%.

For the contributory plans, the small negative increases attached to the improved vesting result from the fact that for most employees terminating membership under the plans, the employee contributions will finance all benefits, and from the assumption that future refunds on death after termination of employment, but before retirement, will be credited with interest at rates 2% below the rates earned by the fund. A younger employee group or the entry age normal actuarial method could produce a considerably higher percentage increase in cost for the improved vesting under the flat benefit plan.

In general, it may be seen that aside from money purchase plans and non-contributory plans, improvement in vesting alone does not provide any additional benefits or employer costs to the employee group. However, a different picture develops if the vested benefits become indexed as will be seen later in this section of the report.

2) Indexing of Retirement Pensions. Table 11 illustrates the cost effect of indexing the benefits payable under the various plans to different indices in the pre- and/or post-retirement period. There would be no other changes from the original plans.

The two indices chosen as being the most logical ones on which to base the indexing of pensions are the Consumer Price Index (CPI) and the Industrial Composite of Average Weekly Earnings (IC), both of which are published by Statistics Canada.(2)

Indexing of benefits in the pre-retirement period affects two distinct groups of plan members: active employees through the indexing of benefits earned currently and in the past; and previously terminated employees who have a vested right to a deferred pension, through the indexing of the benefits earned in the past.

Simulation runs incorporating pre-retirement indexing incorporate it for both groups of plan members in the case of the flat benefit and career average plans, but only for the latter group in the case of the final average plans.

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(2)The Industrial Composite of Average Weekly Earnings (IC) is described in the Task Force report as average wages and salaries (AWS).

Table 11

Introduction of Indexing Provision. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Indexing Measure		Benchmark Plans		
	Pre-Retirement	Post-Retirement	$10.00 Flat Benefit	2% Career Average (%)	2% Final Average
Initial plans	none	none	1.01	2.05	3.96
Pre-retirement only	IC	none	3.90	5.54	4.24
(% increase over line 1)			(+286)	(+170)	(+7)
Post-retirement only	none	CPI	1.31	3.41	5.83
(% increase over line 1)			(+30)	(+66)	(+47)
Pre- and post-retirement	CPI	CPI	3.10	5.74	6.01
(% increase over line 1)			(+207)	(+180)	(+52)
Pre- and post-retirement	IC	IC	-	-	7.95
(% increase over line 1)			-	-	(+101)
Pre- and post-retirement	IC	CPI	4.91	7.77	6.17
(% increase over line 1)			(+386)	(+279)	(+56)

Notes:
1. See the Notes to Table 4. The first three apply here as well.
2. To reduce the number of computer runs required, cost estimates for these variations have not been prepared for all plans.
3. Vesting is assumed to take place after age 45 and completion of 10 years' service.

3. Improvement in Vesting and Indexing Pensions. The combined effect of improving the vesting provisions of the benchmark plans, while also adding an indexing provision may be seen from the following table. Aside from those changes specified, there would be no other changes in the original benchmark plans.

Table 12

Improvement in Vesting and Indexing Features. Estimated Employer Pension Costs for Current Service % of Covered Payroll

		Indexing Measure		Benchmark Plans		
	Vesting	Pre-Retirement	Post-Retirement	$10.00 Flat Benefit	2% Career Average (%)	2% Final Average
Initial plans	45 & 10	none	none	1.01	2.05	3.96
Improve vesting and pre-retirement indexing	35 & 10	IC	none	4.09	5.80	4.45
	10 year	IC	none	4.12	5.82	4.47
	2 year	IC	none	4.25	5.92	4.54
	2 year	CPI	none	2.61	3.99	4.18
Improve vesting and post-retirement indexing	2 year	none	CPI	1.36	3.40	5.82
Improve vesting and pre- and post-retirement indexing	35 & 10	IC	CPI	-	-	6.45
	35 & 5	IC	CPI	-	-	6.49
	35 & 2	IC	CPI	-	-	6.50
	10 year	IC	CPI	5.18	8.18	6.52
	5 year	IC	CPI	-	-	6.62
	2 year	IC	CPI	5.36	8.33	6.64
	2 year	IC	IC	-	-	8.55
	2 year	CPI	CPI	3.32	5.92	6.17

Notes:
1. See the Notes to Table 4. The first three apply here as well.
2. To reduce the number of computer runs required, cost estimates for these variations have not been prepared for all plans.

It may be seen that the indexing provision without improvements in vesting has a much greater cost effect than any improvements in vesting without indexing. It may also be seen that an improvement in the vesting conditions has a much more significant cost effect if those vested benefits are indexed in the pre-retirement period.

It is also instructive to examine the costs of vesting and indexing for a younger, higher turnover group. Using the non-member employee data (see Table 1 and page 4-A-7) the following results were obtained for the 2% final average plan:

	Plan Member Data and Termination Rates			Non-Member Data and Termination Rates(1)		
	Not Indexed	Indexed	% Increase	Not Indexed	Indexed	% Increase
			(%)			
Pre-retirement indexing only(2)						
45 and 10 vesting	4.0	4.2	5	1.3	2.0	53
30 and 2 vesting	4.0	4.5	13	1.3	3.8	192
0 and 10 vesting(3)	4.0	4.5	13	1.3	2.5	92
0 and 2 vesting	4.0	4.5	13	1.3	4.0	207
Pre-retirement and post-retirement indexing(4)						
45 and 10 vesting	4.0	6.2	55	1.3	3.0	131
30 and 2 vesting	4.0	6.6	65	1.3	5.5	323
0 and 10 vesting(3)	4.0	6.5	63	1.3	3.5	169
0 and 2 vesting	4.0	6.6	65	1.3	5.7	338

Notes:
1. The figures shown for the non-member data have been calculated on a more approximate basis than the other figures shown, with the use of a simpler simulation model that the model used to calculate the other figures.
2. Indexed to the Industrial Composite average of wages and salaries before retirement.
3. Full vesting after 10 years of service (no age requirement).
4. Indexed to the Industrial Composite of average wages and salaries before retirement and to the Consumer Price Index after retirement.

4. 2/3 Survivorship Pension. Table 13 shows the cost of adding a post-retirement 2/3 survivorship pension to the plans. The normal form of pension would be altered so as to be either (a) full lifetime pension to the retired employee with continuance fo 2/3 of the pension to the surviving spouse, if any, after the death of the retired employee, or (b) full pension while both spouses are alive, with continuance of 2/3 of the pension for life to the surviving spouse after the death of the first spouse. No other changes from the original plans are reflected in the costs shown. (N.B. The original plans provided a lifetime pension to the retired employee, guaranteed for a minimum of five years.)

Table 13

Variation of Normal Form of Pension. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plans (Not Indexed)					Indexed
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average	2% Final Average
			(%)			
Initial plans	3.24	1.01	2.05	2.08	3.96	6.01
2/3 Survivorship after retired employee's death	3.24	1.18	2.88	2.92	5.11	8.03
(% Increase over line 1)	(0)	(+17)	(+41)	(+40)	(+29)	(+34)
2/3 Survivorship after first death among spouses	3.24	1.15	2.73	2.77	4.90	7.68
(% Increase over line 1)	(0)	(+14)	(+33)	(+33)	(+24)	(+28)

Notes:
1. See the Notes to Table 4. The first three apply here as well.
2. Vesting is attained at age 45 with 10 years of service.

Even though the rate of increase in total (employee and employer) costs for the 2/3 survivorship feature is relatively consistent from one plan to another, the rate of increase in the employer cost varies from one plan to another. This arises because the employee contributions are held constant, even though the total cost varies from plan to plan.

5. Change Age of Entitlement to Full Pension at Age 60. Table 14 shows the cost of the 2% final average plan if retirement on full pension were available at age 60, instead of age 65 (as in the original plans), but not all of the plan members elect to retire at this age (see Annex A for precise details). Many would continue working for a few more years. There would be no other changes from the original plans.

Table 14

Variation of Normal Retirement Age. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Benchmark Plan 2% Final Average %
Initial plan cost	3.96
Full entitlement at age 60 (% increase over line 1)	4.82 (+22)

From the preceding tables, it appears that the addition of the 2/3 survivorship feature is slightly more costly than the change to full entitlement at age 60 and considerably more costly than the change to full vesting of non-indexed accrued benefits (with guaranteed minimum value equal to the employee's own contributions plus interest) after two years of service.

Of course, the full entitlement at 60 would be considerably more costly if most or all of the employees, rather than the assumed number, actually retired at that age. To illustrate an extreme case, the employer costs for the 2% final average non-indexed plan with all employees retiring at age 60 would be 50-75% higher, and with all employees retiring at age 55 would be 75-150% higher, than for the same plan with all employees retiring at age 65.

6. Improved Coverage. Table 15 shows the changes in employer costs if improved coverage of employees by pension plans is arrived at by requiring compulsory membership after a specified age and/or service condition has been met. In effect, the improved coverage brings young employees into

the plan earlier than they would join of their own volition. The overall effect is usually a reduction in the employer's percentage of payroll cost, although there will be an increase in the employer's dollar cost in view of the larger covered payroll.

Table 15

Improved Coverage and Compulsory Membership. Estimated Employer Pension Costs for Current Service % of Covered Payroll

	Compulsory Coverage Condition	Benchmark Plans: 5% Money Purchase (%)	Benchmark Plans: 2% Final Average (%)
Initial plans (45 & 10 vesting, no indexing)	optional at all ages/ services	3.24	3.96
	2 years' service	3.15	3.75
	age 30	3.18	3.78
	both age 30 and 2 years' service	3.19	3.79
Indexed plan (vesting at 2 years, IC/CPI indexing)	optional	3.67	6.64
	both age 30 and 2 years' service	3.65	6.51

E. Reconciliation of Simulation Runs with Traditional Actuarial Estimates

The pension plan costs developed for the benchmark plans by the pension plan simulation model tend to be lower than those generally developed by actuaries for comparable plans for a number of reasons. Some of these reasons relate to the methods and procedures used in developing the model, whereas others are a direct result of the basic data or actuarial assumptions which have made up the model workforce and actuarial valuation basis. Variations in some of these areas have been discussed earlier in this report, but will be repeated here for the convenience of the reader.

1. Variations in Initial Employee Census Data. The initial age, service and salary distribution and the subsequent rates of salary increase and rates of decrement heavily reflect hourly employee characteristics since the composition of the initial employee census data is 74% hourly employees and 26% salaried employees. The hourly group generally has a flatter salary distribution both within a given age group and over the full range of ages of the membership. As such, the cost of a final average earnings pension plan, under traditional actuarial valuations, is usually lower for such a group. The hourly group also has higher rates of termination of employment.

The cost impact may be seen by reference to Table 5, wherein the money purchase and career average pension plans are considerably more expensive for the salaried group than for the hourly paid group, and the final earnings pension plan was slightly more expensive for the salaried group.

2. Variations in Actuarial Assumptions and Methods. There are four areas in which the actuarial assumptions and methods used for the simulation runs vary from traditional actuarial practice.

a) Closed Workforce and Closed Membership Techniques. As previously introduced, the simulation model permits two distinct types of closed group calculations. These are:

- the closed workforce type in which the model permits no new employees in the employer's workforce after the valuation date, but employees who are not then plan members continue to enroll in the plan after the valuation date in accordance with the assumed plan entry probability distribution; and

- the closed membership type in which the model admits no entrants to the plan after the valuation date.

Virtually all of the calculations run on the simulation model have been done on the closed workforce basis. Virtually all private sector actuarial valuations have traditionally been done on the closed membership basis.

Table 16 illustrates the effect on pension plan costs of using the closed membership method, rather than the closed workforce method.

Table 16

Comparison of Closed Group Techniques. Estimated Employer Pension Costs for Current Service
% of Covered Payroll

	Benchmark Plans (Not Indexed)		
Group Technique	5% Money Purchase	2% Career Average	2% Final Average
		(%)	
Closed workforce	3.2	2.1	4.0
Closed membership (% increase over line 1)	3.5 (+9)	2.5 (+19)	4.4 (+10)

b) Economic Assumptions. In the period up to 1990, higher rates of anticipated investment income, salary increases, and price increases are reflected in the economic assumptions detailed in Figure 1.

The use of higher initial annual rates than are traditional does not produce cost estimates which are significantly different from the traditional ones for money purchase and final average plans.

The estimated costs of the benchmark plans, using the ultimate economic assumptions (i.e. interest rate 6.5%, average increase in wages and salaries 5%, average increase in prices 3%) for the full valuation period, are shown in Table 17.

Table 17

Variation in Economic Factors. Estimated Employer Pension Costs for Current Service
% of Covered Payroll

	Benchmark Plans (Not Indexed)				
	5% Money Purchase	$10.00 Flat Benefit	2% Career Average	1 1/2% Final Average	2% Final Average
			(%)		
Initial results	3.24	1.01	2.05	2.08	3.96
Results if ultimate economic factors are used for all time periods	3.34	1.09	2.37	2.14	4.08

c) Termination Rates Used. The termination rates used for the simulation runs were based on the actual experience of the contributing employer, without any modifications to introduce a margin for conservatism. The resulting rates are somewhat greater than those commonly used for actuarial valuation purposes, although this difference has been partly offset in that the rates used distinguish between the experience among plan members (lower turnover) and that of all employees (higher turnover).

As was seen earlier in this section of the report when studying the effect of sensitivity tests on termination rates, however, a significant change in only the termination rates used for valuation purposes did not have a significant effect on the assumed cost of the plan. This is particularly true for the benchmark plans, which are not indexed, in that most employees who terminate service receive a refund, or a vested pension, equal in value to their own contributions with interest at the time they terminate. As such, providing for more employees to terminate at young ages does not provide for significant additional benefits to be paid out of the plan. With a younger employee

group, or under different economic assumptions, or if the plan involves indexing of benefits following termination of employment, the introduction of reduced termination rates would have a larger effect than the results which are shown in Table 7.

d) Merit and Promotion Salary Scale. Studies conducted by American and Canadian government agencies and the experience studies on the data submitted by the contributing employer all indicate that wage and salary increases on average cross over and become negative (after removal of the effect of general wage inflation) after age 45 or 50. Traditional actuarial valuations have not incorporated negative increases beyond these ages. The results of these studies have been reflected in preparing the simulation runs and as a result tend to produce lower costs for a final average earnings pension plan due to this factor.

3. Variations in Plan Provisions. There are a number of features of the benchmark plans which differ from many plans in the private sector.

a) Treatment of Early Retirement Benefits. The benchmark plans do not provide for unreduced early retirement benefits. Although assumptions are made with respect to the incidence of early retirement at each age prior to 65, the benefit provided is the accrued benefit up to the age of early retirement, reduced by 5% for each year by which the early retirement age precedes the normal retirement age.

This is currently a fairly common provision in plans in the private sector. Many plans, however, provide for unreduced benefits upon early retirement if the employee has attained a certain age and/or completed a minimum period of service. Cost estimates for these plans would normally make allowance for the more generous early retirement benefits.

The cost effect of such a provision depends primarily on the extent to which it is utilized. Earlier in this section (see Table 14) the cost effect of a change in the normal retirement age of 65 to 60 was examined. Such a provision is comparable to the introduction of unreduced early retirement under certain age and service conditions.

b) Disability Benefits. As mentioned in Section III, all of the plans which have been simulated provide for a refund of contributions in the event the employee becomes totally and permanently disabled. Many plans currently provide for a deferred pension, commencing at normal retirement age, equal to the pension the employee would have accrued had he remained employed through to the normal retirement date at a fixed salary. Such a provision would normally add in the order of 0.25-0.5% of payroll to the employer's cost.

c) Survivor's Benefits. Aside from the refund of accumulated employee contributions in the event of death prior to normal retirement, the only death benefit provided under the benchmark plans is the five-year guarantee of the pension in the post-retirement period. The possibility of a joint and survivorship normal form of pension was studied in Section III. Some private pension plans presently include a survivor's benefit

in the pre-retirement period equal to the accrued pension of the individual who has completed a specified minimum period of service or who has attained a specified minimum age. Normally, the costs of such a benefit exceed the value of a refund of employee contributions and would therefore tend to add to the costs shown in this appendix.

d) Future Service Benefits Only. Apart from Table 9, the costs shown thus far relate only to the employer costs of future service benefits. Most defined benefit plans are also faced with the costs of past service amortization.

Present legislation requires that the cost of the past service amortization be met in level dollar instalments (although an accelerated funding program is permitted). This produces a series of decreasing percentage of payroll amortization payments, with the largest percentage of payroll cost being incurred in the first year of the 15-year amortization program. An example of the effect of such a funding program on total employer costs may be seen in Table 18. Table 18 shows the total percentage employer costs in the first year of the amortization program, in the 15th year and in the year following completion of the amortization program. The plans shown envisage the extension of the same benefit formula to all past years of service.

Table 18

Effect of Past Service Amortization. Estimated Employer Pension Costs
% of Covered Payroll

		Benchmark Plans			
		Not Indexed		Indexed IC/CPI	
		2% Career Average	2% Final Average	2% Career Average	2% Final Average
		(%)			
With no past service benefits	- 1st year	2.05	3.96	7.77	6.17
	- 15th year	2.05	3.96	7.77	6.17
	- 16th year	2.05	3.96	7.77	6.17
With past service benefits 50% funded	- 1st year	7.07	13.36	17.64	19.29
	- 15th year	4.13	7.85	11.86	11.61
	- 16th year	2.05	3.96	7.77	6.17
With past service benefits 75% funded	- 1st year	4.56	8.66	12.70	12.73
	- 15th year	3.09	5.91	9.81	8.89
	- 16th year	2.05	3.96	7.77	6.17
With past service benefits 90% funded	- 1st year	3.05	5.84	9.74	8.79
	- 15th year	2.46	4.74	8.59	7.26
	- 16th year	2.05	3.96	7.77	6.17
With past service benefits 100% funded	- 1st year	2.05	3.96	7.77	6.17
	- 15th year	2.05	3.96	7.77	6.17
	- 16th year	2.05	3.96	7.77	6.17

Notes:
1. See the Notes to Table 4. The first three apply here as well.
2. Vesting occurs at age 45 with 10 years of service.
3. '50% funded' indicates that the accumulated plan assets are equal to 50% of the actuarial liabilities for accrued benefits under the plan on January 1, 1978.

V. FUTURE DEVELOPMENT OF SIMULATION MODEL

A number of extensions to the pension simulation model are possible, some of which can provide needed information and others of which will provide cosmetic or cost saving improvements.

The model is of primary value in studying policy questions as well as in the area of large pension plan valuations. The operating costs change very little whether there are 1,000 or 100,000 lives involved. However, the model becomes relatively expensive to operate for small actuarial valuations. Therefore, most of the suggestions in this section relate to improvements or extensions to the model which will increase its usefulness in the pension policy area.

For instance, it should be conceivable to modify the model so that not only the economic assumptions but also the demographic assumptions may be varied over time. Decrements such as retirement rates and termination rates, as well as entry patterns to the pension plan are among those demographic factors which one may wish to vary. In addition, it should be possible to modify the model so that distributions of employees and the composition of them broken down as to whether they are salaried or hourly, male or female, could vary over time. Incorporation of the process whereby annuity values are calculated into the model itself is also a possible improvement in the convenience of operation of the model although, when a number of simulation runs are being carried out using the same actuarial assumptions, recalculation of the annuity values for each run will lead to greater running costs than would the introduction of the pre-calculated table.

Another major area which should be pursued is the extension of the model to incorporate additional valuation and funding methods without significantly increasing the cost of operation of a simulation run.

This appendix has given one example of the volatility of costs under one set of specified entry assumptions and economic and demographic assumptions. The model is not presently sufficiently flexible to enable these calculations to be done effectively without resorting to a number of manual calculations. Improvements in this area should be investigated as to their practicability and usefulness.

Another useful extension to the model is the development of benefit and value illustrations for each class of decrement in order to illustrate the cross subsidies that occur within the various types of pension plans.

The model also requires some technical improvements in order to accommodate more types of disability benefits as well as survivor benefits in the pre-retirement period. In addition, more work in the area of unfunded liabilities and the necessary amortization payments and periods should be developed. Further efficiencies which may be considered relate to the extension of the library of decrement and economic factors, the development of standard outputs including supplementary statistical data and menu choices for plan and assumption specifications, as well as

the study of the program and systems design for possible improvements and savings. Complete documentation on the model and the various subsystems of it is in the process of being completed.

ANNEX A TO APPENDIX 4

TABLES OF DEMOGRAPHIC ASSUMPTIONS USED FOR "COMBINED" SIMULATION RUNS

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

DISTRIBUTION OF WAGES AND SALARIES
RATIOS OF WAGES/SALARIES TO INDUSTRIAL COMPOSITE

MEAN VALUES

ALL EMPLOYEES
(ADSCC01)

AGE	BOTTOM THIRD	MIDDLE THIRD	TOP THIRD
18	0.583	0.855	1.059
19	0.636	0.890	1.098
20	0.681	0.926	1.140
21	0.719	0.963	1.185
22	0.750	0.995	1.226
23	0.775	1.024	1.264
24	0.795	1.051	1.302
25	0.812	1.077	1.340
26	0.826	1.100	1.375
27	0.837	1.122	1.410
28	0.847	1.141	1.443
29	0.855	1.159	1.473
30	0.861	1.175	1.502
31	0.867	1.189	1.529
32	0.873	1.202	1.554
33	0.878	1.213	1.577
34	0.882	1.223	1.598
35	0.886	1.231	1.617
36	0.890	1.238	1.633
37	0.893	1.243	1.647
38	0.896	1.247	1.658
39	0.899	1.249	1.667
40	0.901	1.250	1.674
41	0.903	1.250	1.679
42	0.904	1.249	1.683
43	0.905	1.247	1.685
44	0.905	1.245	1.685
45	0.905	1.242	1.684
46	0.904	1.238	1.683
47	0.903	1.235	1.681
48	0.900	1.230	1.678
49	0.897	1.226	1.674
50	0.893	1.222	1.671
51	0.888	1.218	1.667
52	0.882	1.213	1.664
53	0.875	1.209	1.661
54	0.867	1.205	1.658
55	0.859	1.201	1.655
56	0.850	1.198	1.654
57	0.841	1.194	1.653
58	0.832	1.192	1.654
59	0.822	1.188	1.650
60	0.812	1.184	1.646
61	0.803	1.180	1.643
62	0.795	1.176	1.640
63	0.790	1.173	1.639
64	0.789	1.170	1.638
65	0.797	1.166	1.638

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

ENTRY TO EMPLOYER'S WORKFORCE

ANNUAL RATES OF WORKFORCE ENTRY

AGE	ALL EMPLOYEES (APHCC01)
18	0.16571
19	0.09947
20	0.08862
21	0.07931
22	0.06393
23	0.05394
24	0.05095
25	0.04220
26	0.03730
27	0.03160
28	0.02787
29	0.02410
30	0.02263
31	0.01978
32	0.01750
33	0.01534
34	0.01360
35	0.01213
36	0.01076
37	0.00954
38	0.00922
39	0.00862
40	0.00813
41	0.00775
42	0.00741
43	0.00703
44	0.00650
45	0.00607
46	0.00579
47	0.00551
48	0.00528
49	0.00523
50	0.00484
51	0.00447
52	0.00378
53	0.00338
54	0.00291
55	0.00253
56	0.00197
57	0.00164
58	0.00132
59	0.00114
60	0.00096
61	0.00068
62	0.00052
63	0.00035
64	0.00033
65	0.00034

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

ENTRY TO PENSION PLAN - ALL EMPLOYEES

ANNUAL RATES OF PLAN ENTRY
(AQECC01)

	SERVICE						
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-48
18	0.5425	0.3141	0.2943	0.3040	0.3577	0.0000	0.0000
19	0.5260	0.3081	0.2869	0.2949	0.3460	0.0000	0.0000
20	0.3567	0.1915	0.2406	0.2415	0.2458	0.2420	0.0000
21	0.3552	0.1918	0.2386	0.2389	0.2429	0.2391	0.0000
22	0.3541	0.1919	0.2372	0.2371	0.2408	0.2371	0.0000
23	0.3533	0.1921	0.2360	0.2356	0.2391	0.2354	0.0000
24	0.3526	0.1922	0.2351	0.2344	0.2377	0.2341	0.0000
25	0.2431	0.1952	0.2124	0.2034	0.2112	0.2059	0.1017
26	0.2442	0.1975	0.2130	0.2037	0.2114	0.2058	0.1024
27	0.2452	0.1996	0.2135	0.2039	0.2115	0.2058	0.1029
28	0.2461	0.2015	0.2140	0.2041	0.2117	0.2059	0.1034
29	0.2469	0.2032	0.2144	0.2043	0.2119	0.2060	0.1039
30	0.1903	0.1560	0.1622	0.1468	0.1118	0.0897	0.0520
31	0.1916	0.1570	0.1626	0.1470	0.1121	0.0900	0.0523
32	0.1927	0.1578	0.1629	0.1472	0.1123	0.0903	0.0524
33	0.1933	0.1583	0.1631	0.1474	0.1125	0.0905	0.0525
34	0.1936	0.1584	0.1633	0.1475	0.1126	0.0906	0.0525
35	0.1884	0.1327	0.1152	0.1147	0.1166	0.0772	0.0449
36	0.1866	0.1316	0.1147	0.1145	0.1164	0.0767	0.0444
37	0.1835	0.1298	0.1140	0.1141	0.1161	0.0760	0.0437
38	0.1791	0.1273	0.1130	0.1135	0.1157	0.0749	0.0428
39	0.1732	0.1240	0.1117	0.1128	0.1151	0.0735	0.0418
40	0.1313	0.1175	0.1100	0.1176	0.0809	0.0508	0.0493
41	0.1225	0.1140	0.1081	0.1166	0.0793	0.0484	0.0474
42	0.1138	0.1105	0.1063	0.1155	0.0776	0.0461	0.0457
43	0.1058	0.1074	0.1047	0.1145	0.0761	0.0440	0.0443
44	0.0992	0.1048	0.1033	0.1137	0.0749	0.0423	0.0433
45	0.0927	0.1101	0.1281	0.1196	0.1080	0.0300	0.0435
46	0.0896	0.1090	0.1278	0.1193	0.1075	0.0293	0.0430
47	0.0878	0.1084	0.1277	0.1192	0.1072	0.0288	0.0428
48	0.0869	0.1081	0.1276	0.1191	0.1071	0.0286	0.0430
49	0.0868	0.1081	0.1277	0.1191	0.1070	0.0286	0.0433
50	0.0874	0.1142	0.1317	0.1301	0.0586	0.0301	0.0355
51	0.0880	0.1144	0.1318	0.1302	0.0588	0.0304	0.0359
52	0.0889	0.1146	0.1319	0.1302	0.0591	0.0306	0.0364
53	0.0900	0.1149	0.1320	0.1303	0.0593	0.0309	0.0369
54	0.0911	0.1152	0.1322	0.1303	0.0595	0.0312	0.0372
55	0.1422	0.1313	0.1444	0.1393	0.0889	0.0726	0.0285
56	0.1432	0.1318	0.1446	0.1393	0.0889	0.0727	0.0291
57	0.1443	0.1324	0.1449	0.1393	0.0888	0.0726	0.0296
58	0.1451	0.1328	0.1451	0.1393	0.0882	0.0720	0.0297
59	0.1451	0.1328	0.1451	0.1394	0.0881	0.0720	0.0297
60	0.1469	0.1355	0.1374	0.1594	0.1505	0.0420	0.0384
61	0.1463	0.1354	0.1373	0.1594	0.1506	0.0414	0.0364
62	0.1456	0.1352	0.1373	0.1594	0.1506	0.0407	0.0342
63	0.1466	0.1355	0.1374	0.1594	0.1505	0.0418	0.0375
64	0.1478	0.1358	0.1374	0.1594	0.1504	0.0433	0.0420
65	0.1171	0.1033	0.1046	0.1263	0.1173	0.0154	0.0424

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

RETIREMENT RATES

ANNUAL RATES OF RETIREMENT

	NRA 65*		NRA 60*	
AGE	NO INDEX (AQRCC01)	INDEXED (AQRCC02)	NO INDEX (AQRCC03)	INDEXED (AQRCC04)
18	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	0.00
31	0.00	0.00	0.00	0.00
32	0.00	0.00	0.00	0.00
33	0.00	0.00	0.00	0.00
34	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00
36	0.00	0.00	0.00	0.00
37	0.00	0.00	0.00	0.00
38	0.00	0.00	0.00	0.00
39	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00
41	0.00	0.00	0.00	0.00
42	0.00	0.00	0.00	0.00
43	0.00	0.00	0.00	0.00
44	0.00	0.00	0.00	0.00
45	0.00	0.00	0.00	0.00
46	0.00	0.00	0.00	0.00
47	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00
49	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00
51	0.00	0.00	0.00	0.00
52	0.00	0.00	0.00	0.00
53	0.00	0.00	0.00	0.00
54	0.00	0.00	0.00	0.00
55	0.01	0.02	0.01	0.02
56	0.01	0.02	0.01	0.02
57	0.01	0.02	0.01	0.03
58	0.02	0.03	0.02	0.04
59	0.02	0.04	0.03	0.05
60	0.09	0.16	0.18	0.23
61	0.08	0.14	0.15	0.18
62	0.10	0.16	0.16	0.20
63	0.12	0.18	0.17	0.23
64	0.14	0.20	0.18	0.27
65	1.00	1.00	1.00	1.00

* - NRA MEANS 'NORMAL RETIREMENT AGE' UNDER THE PLAN

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

DISABILITY AND MORTALITY RATES

AGE	ANNUAL RATES OF DISABILITY: ALL EMPLOYEES (AQICC01)	ANNUAL RATES OF MORTALITY: ALL EMPLOYEES (AQMCC01)
18	0.0011	0.000422
19	0.0012	0.000439
20	0.0012	0.000458
21	0.0012	0.000479
22	0.0012	0.000501
23	0.0012	0.000524
24	0.0012	0.000549
25	0.0012	0.000577
26	0.0013	0.000607
27	0.0013	0.000640
28	0.0013	0.000677
29	0.0013	0.000717
30	0.0013	0.000762
31	0.0013	0.000812
32	0.0013	0.000866
33	0.0013	0.000927
34	0.0013	0.000993
35	0.0013	0.001067
36	0.0013	0.001147
37	0.0013	0.001235
38	0.0013	0.001334
39	0.0013	0.001443
40	0.0016	0.001563
41	0.0018	0.001712
42	0.0021	0.001911
43	0.0025	0.002155
44	0.0029	0.002445
45	0.0033	0.002774
46	0.0036	0.003144
47	0.0040	0.003551
48	0.0045	0.003994
49	0.0052	0.004474
50	0.0058	0.004985
51	0.0064	0.005530
52	0.0070	0.006106
53	0.0081	0.006717
54	0.0092	0.007361
55	0.0102	0.008041
56	0.0114	0.008754
57	0.0126	0.009507
58	0.0131	0.010339
59	0.0137	0.011334
60	0.0142	0.012479
61	0.0147	0.013742
62	0.0153	0.015099
63	0.0158	0.016561
64	0.0163	0.018185
65	0.0167	0.019881

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

TERMINATION RATES - ALL PLAN MEMBERS

ANNUAL RATES OF TERMINATION OF EMPLOYMENT
(AQWCC01)

SERVICE

AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-48
18	0.1750	0.1875	0.1375	0.1100	0.1025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.1750	0.1875	0.1375	0.1100	0.1025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.1475	0.1584	0.1108	0.0770	0.0780	0.0720	0.0599	0.0550	0.0548	0.0525	0.0000
21	0.1340	0.1303	0.0969	0.0755	0.0775	0.0713	0.0581	0.0534	0.0531	0.0490	0.0000
22	0.1356	0.1337	0.0975	0.0752	0.0770	0.0708	0.0577	0.0529	0.0526	0.0487	0.0000
23	0.1383	0.1397	0.0954	0.0733	0.0744	0.0679	0.0551	0.0500	0.0497	0.0461	0.0000
24	0.1397	0.1427	0.0943	0.0724	0.0731	0.0665	0.0538	0.0486	0.0483	0.0448	0.0000
25	0.1122	0.1193	0.1111	0.0944	0.1038	0.1013	0.0934	0.0857	0.0768	0.0698	0.0555
26	0.1127	0.1202	0.1120	0.0948	0.1043	0.1014	0.0935	0.0859	0.0768	0.0699	0.0558
27	0.1131	0.1207	0.1124	0.0951	0.1046	0.1015	0.0936	0.0860	0.0767	0.0699	0.0559
28	0.1132	0.1210	0.1127	0.0952	0.1047	0.1015	0.0936	0.0860	0.0767	0.0699	0.0560
29	0.1132	0.1211	0.1127	0.0951	0.1047	0.1015	0.0936	0.0860	0.0767	0.0699	0.0560
30	0.0900	0.0978	0.0848	0.0865	0.0883	0.0820	0.0730	0.0745	0.0709	0.0622	0.0508
31	0.0899	0.0976	0.0846	0.0864	0.0882	0.0819	0.0729	0.0744	0.0708	0.0621	0.0507
32	0.0897	0.0974	0.0845	0.0862	0.0880	0.0817	0.0728	0.0743	0.0707	0.0620	0.0506
33	0.0896	0.0971	0.0843	0.0860	0.0878	0.0816	0.0727	0.0741	0.0705	0.0618	0.0505
34	0.0894	0.0969	0.0841	0.0858	0.0876	0.0814	0.0726	0.0740	0.0704	0.0617	0.0504
35	0.0863	0.0944	0.0734	0.0633	0.0756	0.0758	0.0567	0.0618	0.0589	0.0488	0.0366
36	0.0861	0.0942	0.0733	0.0633	0.0755	0.0756	0.0566	0.0617	0.0588	0.0487	0.0365
37	0.0859	0.0940	0.0732	0.0632	0.0753	0.0755	0.0566	0.0616	0.0586	0.0486	0.0364
38	0.0858	0.0938	0.0731	0.0631	0.0752	0.0753	0.0565	0.0615	0.0585	0.0486	0.0364
39	0.0858	0.0937	0.0731	0.0631	0.0752	0.0752	0.0565	0.0614	0.0585	0.0485	0.0363
40	0.0767	0.0844	0.0748	0.0764	0.0679	0.0631	0.0588	0.0548	0.0494	0.0362	0.0248
41	0.0766	0.0844	0.0748	0.0764	0.0678	0.0631	0.0588	0.0548	0.0494	0.0361	0.0248
42	0.0766	0.0844	0.0748	0.0764	0.0678	0.0630	0.0587	0.0548	0.0493	0.0361	0.0248
43	0.0767	0.0844	0.0748	0.0764	0.0678	0.0630	0.0587	0.0548	0.0494	0.0361	0.0248
44	0.0767	0.0844	0.0748	0.0764	0.0678	0.0630	0.0587	0.0548	0.0494	0.0361	0.0248
45	0.0743	0.0747	0.0697	0.0726	0.0724	0.0614	0.0529	0.0508	0.0425	0.0326	0.0171
46	0.0744	0.0747	0.0697	0.0726	0.0724	0.0614	0.0529	0.0509	0.0425	0.0326	0.0171
47	0.0744	0.0747	0.0697	0.0726	0.0725	0.0614	0.0529	0.0509	0.0425	0.0326	0.0171
48	0.0744	0.0748	0.0697	0.0727	0.0725	0.0614	0.0529	0.0509	0.0426	0.0327	0.0171
49	0.0745	0.0748	0.0697	0.0727	0.0725	0.0614	0.0529	0.0509	0.0426	0.0327	0.0171
50	0.0689	0.0683	0.0622	0.0571	0.0583	0.0518	0.0451	0.0393	0.0272	0.0177	0.0108
51	0.0689	0.0683	0.0622	0.0571	0.0583	0.0517	0.0451	0.0393	0.0272	0.0177	0.0108
52	0.0689	0.0683	0.0622	0.0571	0.0583	0.0517	0.0451	0.0393	0.0272	0.0177	0.0108
53	0.0689	0.0683	0.0622	0.0571	0.0583	0.0517	0.0450	0.0393	0.0272	0.0177	0.0108
54	0.0689	0.0683	0.0621	0.0570	0.0582	0.0517	0.0450	0.0393	0.0272	0.0177	0.0108
55	0.0593	0.0581	0.0535	0.0543	0.0556	0.0523	0.0445	0.0372	0.0369	0.0306	0.0051
56	0.0593	0.0581	0.0535	0.0542	0.0556	0.0523	0.0445	0.0372	0.0369	0.0306	0.0051
57	0.0593	0.0581	0.0535	0.0542	0.0555	0.0522	0.0444	0.0371	0.0369	0.0306	0.0051
58	0.0593	0.0581	0.0534	0.0542	0.0555	0.0522	0.0444	0.0371	0.0369	0.0306	0.0050
59	0.0593	0.0581	0.0534	0.0541	0.0554	0.0522	0.0444	0.0371	0.0369	0.0306	0.0050
60	0.0619	0.0510	0.0528	0.0552	0.0504	0.0470	0.0461	0.0379	0.0296	0.0261	0.0045
61	0.0619	0.0510	0.0528	0.0553	0.0505	0.0470	0.0461	0.0379	0.0296	0.0261	0.0045
62	0.0620	0.0510	0.0529	0.0553	0.0505	0.0470	0.0461	0.0380	0.0296	0.0261	0.0045
63	0.0621	0.0511	0.0530	0.0555	0.0507	0.0471	0.0463	0.0381	0.0296	0.0261	0.0045
64	0.0626	0.0514	0.0534	0.0559	0.0511	0.0474	0.0467	0.0384	0.0297	0.0261	0.0046
65	0.0640	0.0525	0.0548	0.0576	0.0527	0.0485	0.0480	0.0397	0.0298	0.0262	0.0047

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

TERMINATION RATES - ALL NON-MEMBERS

ANNUAL RATES OF TERMINATION OF EMPLOYMENT
(AQWCC02)

SERVICE

AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-48
18	0.2430	0.2035	0.1941	0.1895	0.1874	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.2639	0.2169	0.2017	0.1880	0.1851	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.3191	0.2529	0.2007	0.1823	0.1753	0.1679	0.1803	0.1847	0.1759	0.1762	0.0000
21	0.3216	0.2562	0.2033	0.1839	0.1765	0.1686	0.1804	0.1842	0.1754	0.1756	0.0000
22	0.3235	0.2587	0.2052	0.1851	0.1774	0.1690	0.1805	0.1839	0.1751	0.1752	0.0000
23	0.3249	0.2606	0.2067	0.1860	0.1780	0.1694	0.1806	0.1836	0.1748	0.1748	0.0000
24	0.3261	0.2622	0.2079	0.1867	0.1786	0.1697	0.1806	0.1833	0.1745	0.1745	0.0000
25	0.2508	0.2397	0.2009	0.1832	0.1722	0.1549	0.1472	0.1358	0.1320	0.1320	0.1320
26	0.2503	0.2408	0.2017	0.1837	0.1732	0.1560	0.1484	0.1371	0.1331	0.1331	0.1331
27	0.2498	0.2419	0.2024	0.1841	0.1740	0.1571	0.1494	0.1382	0.1341	0.1341	0.1341
28	0.2494	0.2429	0.2030	0.1845	0.1748	0.1580	0.1503	0.1393	0.1350	0.1350	0.1350
29	0.2489	0.2437	0.2036	0.1848	0.1755	0.1588	0.1511	0.1402	0.1358	0.1358	0.1358
30	0.2559	0.2133	0.1907	0.1757	0.1748	0.1563	0.1461	0.1379	0.1157	0.1024	0.0927
31	0.2558	0.2134	0.1907	0.1755	0.1746	0.1565	0.1464	0.1382	0.1161	0.1026	0.0929
32	0.2557	0.2134	0.1905	0.1753	0.1742	0.1565	0.1465	0.1383	0.1164	0.1027	0.0929
33	0.2554	0.2133	0.1902	0.1749	0.1737	0.1565	0.1465	0.1383	0.1165	0.1027	0.0928
34	0.2550	0.2129	0.1897	0.1744	0.1730	0.1562	0.1463	0.1380	0.1163	0.1024	0.0925
35	0.2481	0.2091	0.1873	0.1725	0.1666	0.1643	0.1318	0.1185	0.1103	0.1038	0.0695
36	0.2471	0.2082	0.1864	0.1717	0.1658	0.1630	0.1309	0.1176	0.1096	0.1031	0.0685
37	0.2459	0.2070	0.1851	0.1707	0.1649	0.1614	0.1296	0.1165	0.1085	0.1020	0.0672
38	0.2442	0.2055	0.1836	0.1695	0.1638	0.1595	0.1281	0.1150	0.1072	0.1006	0.0656
39	0.2423	0.2036	0.1819	0.1682	0.1626	0.1575	0.1263	0.1134	0.1056	0.0990	0.0636
40	0.2348	0.1965	0.1756	0.1651	0.1602	0.1523	0.1244	0.0964	0.0693	0.0790	0.0513
41	0.2328	0.1944	0.1741	0.1636	0.1586	0.1502	0.1224	0.0942	0.0674	0.0773	0.0490
42	0.2309	0.1926	0.1727	0.1624	0.1572	0.1484	0.1207	0.0923	0.0656	0.0757	0.0469
43	0.2293	0.1910	0.1716	0.1615	0.1562	0.1470	0.1193	0.0909	0.0641	0.0743	0.0451
44	0.2281	0.1899	0.1709	0.1610	0.1556	0.1461	0.1185	0.0899	0.0630	0.0733	0.0438
45	0.2318	0.1810	0.1653	0.1600	0.1583	0.1424	0.1212	0.0781	0.0417	0.0417	0.0417
46	0.2310	0.1811	0.1654	0.1601	0.1584	0.1424	0.1212	0.0778	0.0412	0.0412	0.0412
47	0.2307	0.1812	0.1655	0.1603	0.1587	0.1427	0.1214	0.0778	0.0410	0.0410	0.0410
48	0.2306	0.1814	0.1658	0.1606	0.1590	0.1431	0.1217	0.0779	0.0411	0.0411	0.0411
49	0.2307	0.1817	0.1660	0.1609	0.1594	0.1435	0.1220	0.0781	0.0413	0.0413	0.0413
50	0.2224	0.1835	0.1624	0.1620	0.1541	0.1390	0.1002	0.0596	0.0442	0.0442	0.0442
51	0.2227	0.1838	0.1626	0.1623	0.1543	0.1393	0.1005	0.0599	0.0445	0.0445	0.0445
52	0.2230	0.1841	0.1627	0.1625	0.1545	0.1396	0.1008	0.0602	0.0448	0.0448	0.0448
53	0.2232	0.1842	0.1628	0.1625	0.1546	0.1397	0.1009	0.0605	0.0451	0.0451	0.0451
54	0.2233	0.1843	0.1628	0.1625	0.1546	0.1397	0.1010	0.0607	0.0454	0.0454	0.0454
55	0.2000	0.1796	0.1714	0.1655	0.1500	0.1399	0.1373	0.1213	0.0942	0.0601	0.0549
56	0.1996	0.1791	0.1709	0.1649	0.1496	0.1393	0.1367	0.1211	0.0940	0.0599	0.0548
57	0.1988	0.1783	0.1699	0.1639	0.1488	0.1381	0.1355	0.1207	0.0935	0.0594	0.0542
58	0.1954	0.1748	0.1660	0.1601	0.1458	0.1338	0.1314	0.1187	0.0912	0.0567	0.0515
59	0.1950	0.1744	0.1655	0.1596	0.1454	0.1333	0.1309	0.1185	0.0909	0.0564	0.0511
60	0.1924	0.1738	0.1637	0.1569	0.1558	0.1370	0.1261	0.1050	0.0837	0.0837	0.0837
61	0.1915	0.1732	0.1633	0.1565	0.1556	0.1367	0.1259	0.1045	0.0832	0.0832	0.0832
62	0.1907	0.1727	0.1631	0.1563	0.1555	0.1365	0.1257	0.1042	0.0827	0.0827	0.0827
63	0.1923	0.1739	0.1639	0.1571	0.1560	0.1372	0.1260	0.1050	0.0837	0.0837	0.0837
64	0.1943	0.1754	0.1648	0.1580	0.1566	0.1379	0.1265	0.1060	0.0850	0.0850	0.0850
65	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

TERMINATION RATES - ALL EMPLOYEES

ANNUAL RATES OF TERMINATION OF EMPLOYMENT
(AQWCC03)

	SERVICE										
AGE	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-48
18	0.2485	0.1839	0.1652	0.1621	0.1574	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.2706	0.1874	0.1633	0.1584	0.1528	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.3028	0.2498	0.1887	0.1688	0.1606	0.1567	0.1550	0.1552	0.1545	0.1547	0.0000
21	0.3030	0.2513	0.1882	0.1676	0.1591	0.1549	0.1531	0.1533	0.1525	0.1528	0.0000
22	0.3038	0.2539	0.1888	0.1673	0.1586	0.1540	0.1521	0.1521	0.1513	0.1515	0.0000
23	0.3052	0.2579	0.1899	0.1672	0.1579	0.1529	0.1506	0.1503	0.1494	0.1497	0.0000
24	0.3062	0.2609	0.1907	0.1670	0.1574	0.1520	0.1494	0.1490	0.1480	0.1482	0.0000
25	0.2087	0.2044	0.1660	0.1496	0.1393	0.1201	0.1147	0.1084	0.0985	0.0853	0.0781
26	0.2080	0.2059	0.1664	0.1495	0.1395	0.1203	0.1150	0.1088	0.0988	0.0855	0.0784
27	0.2074	0.2071	0.1666	0.1494	0.1397	0.1205	0.1151	0.1091	0.0990	0.0856	0.0787
28	0.2068	0.2081	0.1668	0.1493	0.1397	0.1205	0.1152	0.1093	0.0991	0.0857	0.0790
29	0.2062	0.2090	0.1669	0.1491	0.1397	0.1205	0.1152	0.1094	0.0992	0.0856	0.0792
30	0.1992	0.1655	0.1485	0.1417	0.1312	0.1200	0.1112	0.1034	0.0842	0.0715	0.0548
31	0.1993	0.1655	0.1483	0.1414	0.1310	0.1198	0.1109	0.1033	0.0842	0.0714	0.0551
32	0.1993	0.1654	0.1480	0.1410	0.1306	0.1195	0.1106	0.1031	0.0841	0.0711	0.0554
33	0.1993	0.1653	0.1476	0.1407	0.1303	0.1192	0.1103	0.1028	0.0839	0.0708	0.0556
34	0.1993	0.1651	0.1473	0.1403	0.1300	0.1189	0.1100	0.1025	0.0836	0.0704	0.0558
35	0.1884	0.1569	0.1366	0.1276	0.1257	0.1140	0.0991	0.0873	0.0703	0.0653	0.0360
36	0.1883	0.1567	0.1363	0.1272	0.1253	0.1137	0.0986	0.0870	0.0700	0.0652	0.0360
37	0.1881	0.1564	0.1359	0.1268	0.1250	0.1134	0.0982	0.0867	0.0697	0.0650	0.0361
38	0.1880	0.1562	0.1356	0.1265	0.1247	0.1131	0.0978	0.0865	0.0694	0.0648	0.0361
39	0.1878	0.1560	0.1354	0.1263	0.1245	0.1128	0.0975	0.0862	0.0692	0.0646	0.0361
40	0.1765	0.1441	0.1309	0.1216	0.1160	0.0992	0.0796	0.0590	0.0425	0.0327	0.0238
41	0.1764	0.1439	0.1307	0.1214	0.1158	0.0990	0.0795	0.0588	0.0423	0.0324	0.0238
42	0.1762	0.1438	0.1306	0.1213	0.1157	0.0989	0.0794	0.0586	0.0422	0.0323	0.0238
43	0.1762	0.1437	0.1305	0.1212	0.1156	0.0988	0.0793	0.0586	0.0421	0.0322	0.0238
44	0.1761	0.1437	0.1305	0.1212	0.1156	0.0988	0.0793	0.0585	0.0420	0.0321	0.0238
45	0.1667	0.1296	0.1229	0.1189	0.1115	0.0967	0.0768	0.0411	0.0253	0.0220	0.0171
46	0.1668	0.1296	0.1229	0.1189	0.1115	0.0966	0.0768	0.0411	0.0253	0.0220	0.0171
47	0.1668	0.1296	0.1229	0.1189	0.1115	0.0966	0.0768	0.0411	0.0253	0.0220	0.0171
48	0.1669	0.1296	0.1228	0.1188	0.1115	0.0966	0.0768	0.0411	0.0254	0.0221	0.0171
49	0.1670	0.1296	0.1228	0.1188	0.1115	0.0966	0.0767	0.0412	0.0254	0.0221	0.0171
50	0.1472	0.1232	0.1176	0.1149	0.1014	0.0727	0.0620	0.0320	0.0202	0.0180	0.0118
51	0.1472	0.1232	0.1175	0.1148	0.1013	0.0726	0.0620	0.0321	0.0202	0.0180	0.0118
52	0.1472	0.1231	0.1174	0.1147	0.1012	0.0726	0.0620	0.0321	0.0202	0.0180	0.0118
53	0.1472	0.1230	0.1172	0.1145	0.1011	0.0725	0.0619	0.0321	0.0202	0.0180	0.0118
54	0.1472	0.1229	0.1171	0.1143	0.1009	0.0725	0.0618	0.0321	0.0202	0.0180	0.0118
55	0.1400	0.1256	0.1191	0.1179	0.1043	0.0876	0.0765	0.0539	0.0495	0.0412	0.0065
56	0.1398	0.1253	0.1188	0.1176	0.1041	0.0874	0.0763	0.0539	0.0493	0.0411	0.0065
57	0.1395	0.1250	0.1184	0.1172	0.1039	0.0871	0.0760	0.0537	0.0492	0.0410	0.0065
58	0.1392	0.1246	0.1180	0.1168	0.1035	0.0868	0.0757	0.0536	0.0491	0.0409	0.0065
59	0.1391	0.1245	0.1179	0.1166	0.1034	0.0867	0.0756	0.0536	0.0490	0.0409	0.0065
60	0.1364	0.1252	0.1229	0.1178	0.1235	0.1111	0.0930	0.0654	0.0399	0.0507	0.0076
61	0.1365	0.1252	0.1229	0.1178	0.1235	0.1111	0.0930	0.0654	0.0400	0.0508	0.0076
62	0.1366	0.1253	0.1230	0.1179	0.1235	0.1112	0.0930	0.0655	0.0402	0.0510	0.0076
63	0.1369	0.1255	0.1232	0.1181	0.1236	0.1113	0.0930	0.0658	0.0407	0.0515	0.0077
64	0.1376	0.1262	0.1238	0.1187	0.1240	0.1118	0.0931	0.0663	0.0420	0.0528	0.0077
65	0.2815	0.2718	0.2739	0.2763	0.2721	0.2685	0.2686	0.2623	0.2543	0.2515	0.2351

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

WAGE AND SALARY INCREASES FROM SENIORITY, MERIT AND PROMOTION

ANNUAL RATES OF WAGE OR SALARY INCREASE

AGE	*ALL EMPLOYEES (ASICC01)*
18	0.054
19	0.048
20	0.042
21	0.037
22	0.032
23	0.028
24	0.024
25	0.022
26	0.020
27	0.018
28	0.017
29	0.016
30	0.015
31	0.014
32	0.013
33	0.013
34	0.012
35	0.011
36	0.010
37	0.010
38	0.009
39	0.008
40	0.008
41	0.007
42	0.006
43	0.005
44	0.004
45	0.003
46	0.003
47	0.002
48	0.001
49	0.000
50	0.000
51	-0.001
52	-0.001
53	-0.002
54	-0.003
55	-0.004
56	-0.005
57	-0.006
58	-0.007
59	-0.008
60	-0.010
61	-0.012
62	-0.014
63	-0.016
64	-0.018
65	-0.020

DEMOGRAPHIC ASSUMPTIONS
ACTIVE EMPLOYEES

PROPORTIONS MARRIED AND AGE DIFFERENCES

AGE	PROPORTION OF EMPLOYEES MARRIED ALL EMPLOYEES (APMCC01)	AGE DIFFERENCE BETWEEN SPOUSES ALL EMPLOYEES (APDCC01)
18	0.06953	-0.88480
19	0.16903	-0.86963
20	0.25797	-0.82994
21	0.32867	0.06042
22	0.40673	0.16348
23	0.47704	0.31711
24	0.54029	0.47927
25	0.59717	0.65870
26	0.64757	0.82706
27	0.69208	0.99202
28	0.73109	1.15053
29	0.76501	1.29997
30	0.79423	1.43823
31	0.81913	1.56368
32	0.84011	1.67513
33	0.85754	1.77181
34	0.87180	1.85338
35	0.88324	1.91984
36	0.89221	1.97153
37	0.89904	2.00917
38	0.90406	2.03368
39	0.90757	2.04632
40	0.90985	2.04851
41	0.91118	2.04189
42	0.91180	2.02820
43	0.91193	2.00934
44	0.91179	1.98726
45	0.91152	1.96391
46	0.91129	1.94128
47	0.91120	1.92129
48	0.91133	1.90578
49	0.91175	1.89648
50	0.91245	1.89496
51	0.91340	1.90261
52	0.91456	1.92056
53	0.91581	1.94970
54	0.91700	1.99058
55	0.91792	2.04340
56	0.91835	2.10793
57	0.91797	2.18350
58	0.91645	2.26889
59	0.91332	2.36225
60	0.90812	2.46100
61	0.90018	2.56157
62	0.88871	2.65894
63	0.87243	2.74527
64	0.84866	2.80459
65	0.79626	2.78545

DEMOGRAPHIC ASSUMPTIONS
TERMINATED VESTED DEFERRED PENSIONERS

RETIREMENT, DISABILITY AND MORTALITY RATES

AGE	ANNUAL RATES OF RETIREMENT NRA 65* ALL LIVES (DQRCC01)	ANNUAL RATES OF RETIREMENT NRA 60* ALL LIVES (DQRCC02)	ANNUAL RATES OF DISABILITY ALL LIVES (DQICC01)	ANNUAL RATES OF MORTALITY ALL LIVES (DQMCC01)
18	0.00	0.00	0.000000	0.000449
19	0.00	0.00	0.000000	0.000464
20	0.00	0.00	0.000000	0.000481
21	0.00	0.00	0.000000	0.000500
22	0.00	0.00	0.000000	0.000521
23	0.00	0.00	0.000000	0.000543
24	0.00	0.00	0.000000	0.000567
25	0.00	0.00	0.000000	0.000594
26	0.00	0.00	0.000000	0.000625
27	0.00	0.00	0.000000	0.000658
28	0.00	0.00	0.000000	0.000694
29	0.00	0.00	0.000000	0.000734
30	0.00	0.00	0.000000	0.000778
31	0.00	0.00	0.000000	0.000827
32	0.00	0.00	0.000000	0.000881
33	0.00	0.00	0.000000	0.000941
34	0.00	0.00	0.000000	0.001007
35	0.00	0.00	0.000000	0.001080
36	0.00	0.00	0.000000	0.001158
37	0.00	0.00	0.000000	0.001246
38	0.00	0.00	0.000000	0.001344
39	0.00	0.00	0.000000	0.001451
40	0.00	0.00	0.000000	0.001570
41	0.00	0.00	0.000000	0.001719
42	0.00	0.00	0.000000	0.001918
43	0.00	0.00	0.000000	0.002163
44	0.00	0.00	0.000000	0.002453
45	0.00	0.00	0.000000	0.002785
46	0.00	0.00	0.000000	0.003156
47	0.00	0.00	0.000000	0.003565
48	0.00	0.00	0.000000	0.004009
49	0.00	0.00	0.000000	0.004490
50	0.00	0.00	0.000000	0.005003
51	0.00	0.00	0.000000	0.005548
52	0.00	0.00	0.000000	0.006123
53	0.00	0.00	0.000000	0.006732
54	0.00	0.00	0.000000	0.007371
55	0.00	0.00	0.000000	0.008045
56	0.00	0.00	0.000000	0.008750
57	0.00	0.00	0.000000	0.009490
58	0.00	0.00	0.000000	0.010303
59	0.00	0.00	0.000000	0.011291
60	0.00	1.00	0.000000	0.012432
61	0.00	0.00	0.000000	0.013694
62	0.00	0.00	0.000000	0.015055
63	0.00	0.00	0.000000	0.016539
64	0.00	0.00	0.000000	0.018232
65	1.00	0.00	0.000000	0.020206

* - NRA MEANS 'NORMAL RETIREMENT AGE' UNDER THE PLAN

DEMOGRAPHIC ASSUMPTIONS
TERMINATED VESTED DEFERRED PENSIONS

PROPORTIONS MARRIED AND AGE DIFFERENCES

AGE	PROPORTION OF EMPLOYEES MARRIED ALL EMPLOYEES (DPMCC01)	AGE DIFFERENCE BETWEEN SPOUSES ALL EMPLOYEES (DPDCC01)
18	0.04526	-0.12710
19	0.14810	-0.09948
20	0.24239	-0.02727
21	0.32847	0.08009
22	0.40670	0.21409
23	0.47744	0.36547
24	0.54108	0.52739
25	0.59799	0.69455
26	0.64858	0.86231
27	0.69323	1.02672
28	0.73234	1.18447
29	0.76632	1.33283
30	0.79556	1.46961
31	0.82045	1.59319
32	0.84138	1.70241
33	0.85873	1.79654
34	0.87289	1.87532
35	0.88420	1.93883
36	0.89303	1.98751
37	0.89973	2.02212
38	0.90460	2.04367
39	0.90796	2.05341
40	0.91009	2.05284
41	0.91128	2.04357
42	0.91175	2.02735
43	0.91174	2.00607
44	0.91145	1.98164
45	0.91104	1.95600
46	0.91065	1.93110
47	0.91041	1.90883
48	0.91037	1.89098
49	0.91060	1.87926
50	0.91109	1.87521
51	0.91182	1.88016
52	0.91272	1.89526
53	0.91368	1.92136
54	0.91454	1.95905
55	0.91511	2.00855
56	0.91514	2.06975
57	0.91435	2.14212
58	0.91239	2.22468
59	0.90887	2.31600
60	0.90335	2.41414
61	0.89531	2.51660
62	0.88421	2.62032
63	0.86942	2.72159
64	0.85028	2.81608
65	0.81607	2.91158

DEMOGRAPHIC ASSUMPTIONS
CURRENT AND FUTURE PENSIONERS AND SURVIVORS

MORTALITY RATES

	ANNUAL RATES OF MORTALITY			ANNUAL RATES OF MORTALITY	
AGE	NORMAL PENSIONERS (PQMCC01)	DISABLED PENSIONERS (IQMCC01)	AGE	NORMAL PENSIONERS (PQMCC01)	DISABLED PENSIONERS (IQMCC01)
18	0.000455	0.06609	66	0.022786	0.11666
19	0.000470	0.06609	67	0.025353	0.11669
20	0.000487	0.06609	68	0.028120	0.11672
21	0.000506	0.06609	69	0.031258	0.11675
22	0.000527	0.06609	70	0.034820	0.11710
23	0.000549	0.06609	71	0.038632	0.11851
24	0.000574	0.06609	72	0.042392	0.12098
25	0.000601	0.06609	73	0.046023	0.12238
26	0.000632	0.06609	74	0.049741	0.12498
27	0.000665	0.06609	75	0.053793	0.12634
28	0.000702	0.06609	76	0.058518	0.13155
29	0.000742	0.06609	77	0.064276	0.13695
30	0.000787	0.06609	78	0.070818	0.14254
31	0.000836	0.06609	79	0.077788	0.14832
32	0.000891	0.06609	80	0.085378	0.15428
33	0.000951	0.06609	81	0.093245	0.16043
34	0.001017	0.06609	82	0.101349	0.16751
35	0.001091	0.06609	83	0.109817	0.17499
36	0.001171	0.06611	84	0.118521	0.18248
37	0.001259	0.06612	85	0.127422	0.19005
38	0.001358	0.06614	86	0.136574	0.19873
39	0.001467	0.06615	87	0.145946	0.20851
40	0.001587	0.06618	88	0.155718	0.21860
41	0.001738	0.06621	89	0.165970	0.22950
42	0.001941	0.06624	90	0.176775	0.24150
43	0.002190	0.06642	91	0.187915	0.25581
44	0.002485	0.06674	92	0.199283	0.27171
45	0.002822	0.06722	93	0.210852	0.28804
46	0.003200	0.06789	94	0.224623	0.30446
47	0.003616	0.06873	95	0.239524	0.32112
48	0.004069	0.06984	96	0.254944	0.33796
49	0.004558	0.07122	97	0.271535	0.35500
50	0.005080	0.07296	98	0.289513	0.37173
51	0.005635	0.07512	99	0.308834	0.38844
52	0.006221	0.07767	100	0.329943	0.40524
53	0.006840	0.08076	101	0.353038	0.42222
54	0.007490	0.08421	102	0.378330	0.43944
55	0.008174	0.08885	103	0.407788	0.45646
56	0.008889	0.09206	104	0.443464	0.47447
57	0.009640	0.09617	105	0.487410	0.49629
58	0.010463	0.10037	106	0.541675	0.51669
59	0.011464	0.10454	107	0.607380	0.53775
60	0.012619	0.10878	108	0.689376	0.55973
61	0.013897	0.11078	109	0.786914	0.58296
62	0.015276	0.11174	110	1.000000	0.60768
63	0.016778	0.11336			
64	0.018492	0.11478			
65	0.020494	0.11618			

ANNEX B TO APPENDIX 4

SAMPLE INPUT AND OUTPUT SHEETS

Groups:

1. Combined
2.
3.
4.

Run No(s) 1.06
Description of Run(s) Basic Plans
Present System
Plans 1 - 5

INPUT SPECIFICATIONS SHEET

	Input Code				
	1st 3 Digits	Last Four Digits			
	All Groups	Group 1	Group 2	Group 3	Group 4
A. INPUT DATA					
1. Active non-plan members	ADN	CC01			
2. Active plan members	ADM	CC01			
3. Deferred vesteds	DDM	CC01			
4. Pensioners and survivors	PDM	CC01			
5. Starting salary distribution	ADS	CC01			
6. Industrial Composite history	IC	2777			
Special adjustments:					
B. ECONOMIC ASSUMPTIONS					
1. Rate of return on pension fund	EI	7801			
2. Average wage/salary increase	ES	7801			
3. Consumer price increase	EP	7801			
4. YMPE increase	EY	7801			
5. Work force growth	GW	7801			
6. Rate of return on employee contributions	EC	EI7801-2%			
Special adjustments:					
C. DEMOGRAPHIC ASSUMPTIONS					
Active Employees					
1. Work force entry	APH	CC01			
2. Plan entry	AQE	CC01			
3. Retirement	AQR	CC01			
4. Disability	AQI	CC01			
5. Mortality	AQM	CC01			
6. Termination of service					
(a) members	AQW	CC01			
(b) non-members	AQW	CC02			
7. Wage/salary increase	ASI	CC01			
8. Wage/salary distribution on entry	ASD	CC01			
9. Proportion married	APM	N/A			
10. Spouse age difference	APD	N/A			
Deferred Vesteds					
1. Retirement	DQR	CC01			
2. Disability	DQI	N/A			
3. Mortality	DQM	CC01			
4. Proportion married	DPM	N/A			
5. Spouse age difference	DPD	N/A			
Pensioners and Survivors					
1. Normal mortality	PQM	CC01			
2. Disabled mortality	PQM	N/A			
Special adjustments:					

D. OPEN GROUP INSTRUCTION

1. Open group for 0 years; close group thereafter.

Date ____________________

Initials ____________________

PPSV MODEL OUTPUT

RUN DETAILS: DEC 17,1977 5:24:56 P.M.
RUN NO. RUNIX06
PAGE NO. 1

XYZ COMPANY HOURLY EMPLOYEES PENSION PLAN

PLAN NO. 1 ACTUARIAL ASSUMPTIONS NO CLOSED GROUP

PLAN DETAILS:
ASSUMPTIONS:

DISPLAY OF BENEFIT AMOUNTS FOR SELECTED YEARS

YEAR	PENSION BENEFITS							REFUND BENEFITS				
	RETIRED EMPLOYEES	TERMINATED EMPLOYEES	DISABLED EMPLOYEES	SPOUSES OF DECEASED EMPLOYEES	SPOUSES OF DECEASED PENSIONERS	ESTATES	TOTAL PENSIONS	DECEASED EMPLOYEES	TERMINATED EMPLOYEES	DISABLED EMPLOYEES	TOTAL REFUNDS	TOTAL PAYOUT
1978	592	0	0	0	0	3	595	1115	5275	1186	7575	8170
1979	3455	4	0	0	0	33	3492	3548	17229	3780	24556	28048
1980	9663	18	0	0	0	152	9833	6278	29087	6691	42057	51889
1981	20025	56	0	0	0	435	20516	9221	40121	9824	59166	79682
1982	35198	136	0	0	0	990	36324	12294	49234	13089	74617	110941
1983	54705	267	0	0	0	1864	56836	15575	55987	16548	88110	144946
1984	78656	462	0	0	0	2949	82067	19086	60619	20197	99903	181969
1985	108931	768	0	0	0	4179	113879	22649	62067	23870	108587	222465
1986	146123	1219	0	0	0	5546	152888	26211	60759	27520	114490	267378
1987	189496	1826	0	0	0	7011	198333	29863	59598	31230	120692	319025
1988	241863	2709	0	0	0	8701	253273	33390	60924	34821	129135	382407
1989	302612	3906	0	0	0	10762	317280	36814	62039	38309	137162	454442
1990	369895	5423	0	0	0	13030	388347	40079	62551	41633	144263	532610
1991	443944	7331	0	0	0	15440	466715	43129	61829	44756	149714	616429
1992	520666	9518	0	0	0	18083	548267	46295	60584	47954	154833	703100
1993	599744	11992	0	0	0	20506	632242	49569	58238	51211	159017	791260
1994	689245	15278	0	0	0	22622	727145	52397	54625	54106	161129	888274
1995	785643	19310	0	0	0	24806	829759	54995	51028	56830	162853	992612
1996	881073	23719	0	0	0	26869	931661	57757	47278	59702	164737	1096397
1997	976040	28506	0	0	0	29201	1033747	60685	42525	62720	165931	1199677
1998	1072191	33815	0	0	0	31888	1137894	63664	37674	65803	167142	1305035
1999	1177769	40519	0	0	0	33888	1252176	66127	32747	68507	167381	1419557
2000	1282458	47705	0	0	0	35362	1365525	68781	27421	71385	167588	1533112
2001	1381589	54894	0	0	0	37176	1473660	71757	21784	74522	168064	1641723
2002	1484466	62945	0	0	0	39324	1586735	74579	16775	77534	168888	1755624
2003	1592692	72111	0	0	0	41751	1706553	77063	13200	80273	170536	1877090

P P S V   M O D E L   O U T P U T

RUN DETAILS: DEC 17,1977   5:24:58 P.M.
RUN NO. RUNIX06
PAGE NO. 1

XYZ COMPANY HOURLY EMPLOYEES PENSION PLAN

PLAN NO. 1   ACTUARIAL ASSUMPTIONS NO   CLOSED GROUP

PLAN DETAILS:
ASSUMPTIONS:

D I S P L A Y   O F   B E N E F I T   A M O U N T S   F O R   S E L E C T E D   Y E A R S

YEAR	PENSION BENEFITS							REFUND BENEFITS				
	RETIRED EMPLOYEES	TERMINATED EMPLOYEES	DISABLED EMPLOYEES	SPOUSES OF DECEASED EMPLOYEES	SPOUSES OF DECEASED PENSIONERS	ESTATES	TOTAL PENSIONS	DECEASED EMPLOYEES	TERMINATED EMPLOYEES	DISABLED EMPLOYEES	TOTAL REFUNDS	TOTAL PAYOUT
1978	592	0	0	0	0	3	595	1115	5275	1186	7575	8170
1979	3455	4	0	0	0	33	3492	3548	17229	3780	24556	28048
1980	9663	18	0	0	0	152	9833	6278	29087	6691	42057	51889
1981	20025	56	0	0	0	435	20516	9221	40121	9824	59166	79682
1982	35198	136	0	0	0	990	36324	12294	49234	13089	74617	110941
1983	54705	267	0	0	0	1864	56836	15575	55987	16548	88110	144946
1984	78656	462	0	0	0	2949	82067	19086	60619	20197	99903	181969
1985	108931	768	0	0	0	4179	113879	22649	62067	23870	108587	222465
1986	146123	1219	0	0	0	5546	152888	26211	60759	27520	114490	267378
1987	189496	1826	0	0	0	7011	198333	29863	59598	31230	120692	319025
1988	241863	2709	0	0	0	8701	253273	33390	60924	34821	129135	382407
1989	302612	3906	0	0	0	10762	317280	36814	62039	38309	137162	454442
1990	369895	5423	0	0	0	13030	388347	40079	62551	41633	144263	532610
1991	443944	7331	0	0	0	15440	466715	43129	61829	44756	149714	616429
1992	520666	9518	0	0	0	18083	548267	46295	60584	47954	154833	703100
1993	599744	11992	0	0	0	20506	632242	49569	58238	51211	159017	791260
1994	689245	15278	0	0	0	22622	727145	52397	54625	54106	161129	888274
1995	785643	19310	0	0	0	24806	829759	54995	51028	56830	162853	992612
1996	881073	23719	0	0	0	26869	931661	57757	47278	59702	164737	1096397
1997	976040	28506	0	0	0	29201	1033747	60685	42525	62720	165931	1199677
1998	1072191	33815	0	0	0	31888	1137894	63664	37674	65803	167142	1305035
1999	1177769	40519	0	0	0	33888	1252176	66127	32747	68507	167381	1419557
2000	1282458	47705	0	0	0	35362	1365525	68781	27421	71385	167588	1533112
2001	1381589	54894	0	0	0	37176	1473660	71757	21784	74522	168064	1641723
2002	1484466	62945	0	0	0	39324	1586735	74579	16775	77534	168888	1755624
2003	1592692	72111	0	0	0	41751	1706553	77063	13200	80273	170536	1877090

PPSV MODEL OUTPUT

RUN DETAILS: DEC 17,1977 5:24:58 P.M.
RUN NO. RUN1X06
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XYZ COMPANY HOURLY EMPLOYEES PENSION PLAN

PLAN NO. 1 • ACTUARIAL ASSUMPTIONS NO CLOSED GROUP

PLAN DETAILS:
ASSUMPTIONS:

SUMMARY OF VALUATION RESULTS AND CASH FLOW ANALYSIS

YEAR	LIVES TOTAL	TOTAL PAYROLL	MEM BERS	COVERED PAYROLL	PRES VALUE OF ULTIMATE BENEFITS	PRES VALUE OF ACCRUED BENEFITS	PRES VALUE FUTURE EE CONTRIBS	PRES VALUE OF FUTURE ER CONTRIBS	FUND VALUE JAN 1ST	INVESTMENT INCOME	BENEFIT PAYOUT	EE AND ER CONTRIB
1978	998	16832808	579	10128590	12727460	0	6314331	6413129	0	33935	8171	828003
1979	920	17105645	600	11382419	13800796	0	6412342	6534687	853768	109498	28049	912234
1980	852	17418785	600	12395242	14944696	0	6475737	6621508	1847451	196035	51889	980294
1981	792	17468440	586	12997986	16161030	0	6510429	6678710	2971891	257833	79682	1014712
1982	737	17515017	563	13409394	17290613	0	6469945	6655913	4164755	347075	110941	1036137
1983	686	17572473	535	13702874	18472549	0	6413354	6617169	5437026	441880	144945	1051308
1984	640	17652110	506	13946124	19707912	0	6357967	6564675	6785269	542176	181966	1064578
1985	599	17595301	479	14051603	20997586	0	6288978	6498551	8210057	604539	222460	1065836
1986	560	17527293	452	14122478	22237602	0	6186994	6392637	9657971	704606	267369	1071746
1987	524	17477619	426	14185685	23518016	0	6074536	6276525	11166954	808678	319010	1076415
1988	490	17428421	402	14237052	24834693	0	5951764	6149893	12733037	916349	382387	1078984
1989	458	17337324	377	14233754	26178084	0	5818796	6013305	14345983	1026826	454416	1078999
1990	427	17074038	354	14084906	27541049	0	5676239	5867418	15997392	1058048	532572	1067319
1991	398	16784099	331	13909351	28782186	0	5502293	5689707	17590186	1158520	616379	1054080
1992	371	16486649	310	13722564	30017556	0	5323556	5507593	19186407	1259071	703038	1041306
1993	346	16214465	290	13554389	31243790	0	5139385	5320660	20783746	1359700	791169	1028319
1994	322	15925421	271	13371652	32458815	0	4949734	5128485	22380596	1460057	888159	1012563
1995	299	15572546	253	13124742	33652861	0	4755519	4932285	23965057	1559108	992464	994897
1996	278	15243347	235	12894618	34816861	0	4557463	4732799	25526599	1656739	1096218	977913
1997	258	14916617	219	12666599	35949450	0	4354993	4529425	27065032	1752877	1199480	960799
1998	240	14589605	205	12440078	37049093	0	4148034	4321832	28579227	1847407	1304800	943413
1999	222	14254628	191	12199552	38111558	0	3936323	4109987	30065248	1939850	1419218	923226
2000	205	13859619	177	11899878	39125135	0	3720972	3895057	31509106	2029223	1532721	902351
2001	191	13515930	164	11648812	40087322	0	3502243	3677120	32907958	2116104	1641261	882195
2002	176	13140071	152	11367055	41000101	0	3279540	3455565	34264996	2199994	1755095	860220
2003	163	12749386	141	11068761	41854764	0	3053532	3231117	35570115	2280274	1876443	835920
2004	149	12307141	130	10725669	42639841	0	2825176	3004799	36809866	2356022	1998974	809926
2005	137	11873358	120	10387852	43349427	0	2595272	2777314	37976841	2427136	2121505	783589

PPSV MODEL OUTPUT

RUN DETAILS: DEC 17,1977 5:24:58 P.M.
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XYZ COMPANY HOURLY EMPLOYEES PENSION PLAN

PLAN NO. 1 ACTUARIAL ASSUMPTIONS NO CLOSED GROUP

PLAN DETAILS:
ASSUMPTIONS:

SUMMARY OF VALUATION RESULTS AND CASH FLOW ANALYSIS

YEAR	TOTAL PAYROLL	COVERED PAYROLL	EMPLOYEE CONTRIBS	EMPLOYER TOTAL CONTRIBS	PCT OF EE.	EMPLOYER FUTSERV CONTRIBS	PCT OF EE.	EMPLOYER PASTSERV CONTRIBS	PCT OF EE.	PERCENT OF COVERED PAYROLL TOTAL	FUT	PAST	ER CPP CONTRIBS	TOTAL EMPLOYER CONTRIBS	PCT OF PAY
1978	16832808	10128590	421270	406733	96.55	406733	96.55	0	.00	3.96	3.96	.00	276205	682938	4.22
1979	17105645	11382419	462367	449866	97.30	449866	97.30	0	.00	3.96	3.96	.00	287364	737230	4.47
1980	17418785	12395242	495003	485292	98.04	485292	98.04	0	.00	3.96	3.96	.00	298681	783973	4.66
1981	17468440	12997986	509798	504914	99.04	504914	99.04	0	.00	3.96	3.96	.00	311963	816877	4.84
1982	17515017	13409394	517539	518598	100.20	518598	100.20	0	.00	3.96	3.96	.00	325579	844177	4.99
1983	17572473	13702874	522272	529036	101.30	529036	101.30	0	.00	3.96	3.96	.00	395511	924547	5.44
1984	17652110	13946124	526199	538380	102.31	538380	102.31	0	.00	3.96	3.96	.00	408816	947196	5.54
1985	17595301	14051603	523933	541903	103.43	541903	103.43	0	.00	3.96	3.96	.00	421956	963859	5.66
1986	17527293	14122478	527154	544592	103.31	544592	103.31	0	.00	3.96	3.96	.00	417657	962249	5.66
1987	17477619	14185685	529513	546902	103.28	546902	103.28	0	.00	3.96	3.96	.00	417150	964052	5.69
1988	17428421	14237052	531044	547940	103.18	547940	103.18	0	.00	3.96	3.96	.00	472680	1020620	6.05
1989	17337324	14233754	531315	547684	103.08	547684	103.08	0	.00	3.96	3.96	.00	468181	1015865	6.05
1990	17074038	14084906	525820	541499	102.98	541499	102.98	0	.00	3.96	3.96	.00	460287	1001786	6.06
1991	16784099	13909351	519507	534573	102.90	534573	102.90	0	.00	3.96	3.96	.00	450660	985233	6.07
1992	16486649	13722564	513524	527782	102.78	527782	102.78	0	.00	3.96	3.96	.00	442195	969977	6.08
1993	16214465	13554389	507233	521086	102.73	521086	102.73	0	.00	3.96	3.96	.00	488102	1009188	6.43
1994	15925421	13371652	499696	512867	102.64	512867	102.64	0	.00	3.96	3.96	.00	477067	989934	6.43
1995	15572546	13124742	491194	503703	102.55	503703	102.55	0	.00	3.96	3.96	.00	465409	969112	6.44
1996	15243347	12894618	483002	494911	102.47	494911	102.47	0	.00	3.96	3.96	.00	454522	949433	6.44
1997	14916617	12666599	474603	486196	102.44	486196	102.44	0	.00	3.96	3.96	.00	444733	930929	6.46
1998	14589605	12440078	466173	477240	102.37	477240	102.37	0	.00	3.96	3.96	.00	434232	911473	6.46
1999	14254628	12199552	456353	466872	102.31	466872	102.31	0	.00	3.96	3.96	.00	422090	888962	6.47
2000	13859619	11899878	446080	456270	102.28	456270	102.28	0	.00	3.96	3.96	.00	411169	867439	6.48
2001	13515930	11648812	436151	446045	102.27	446045	102.27	0	.00	3.96	3.96	.00	400160	846204	6.49
2002	13140071	11367055	425326	434894	102.25	434894	102.25	0	.00	3.96	3.96	.00	389234	824128	6.51
2003	12749386	11068761	413359	422561	102.23	422561	102.23	0	.00	3.96	3.96	.00	376729	799289	6.52
2004	12307141	10725669	400482	409444	102.24	409444	102.24	0	.00	3.96	3.96	.00	363875	773318	6.53
2005	11873358	10387852	387441	396147	102.25	396147	102.25	0	.00	3.96	3.96	.00	351090	747237	6.55

PPSV MODEL OUTPUT

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XYZ COMPANY HOURLY EMPLOYEES PENSION PLAN

ACTUARIAL ASSUMPTIONS NO CLOSED GROUP

SUMMARY OF RESULTS FOR VARIOUS &CLOSED FIT PROVISIONS

YEAR	PLAN 1			PLAN 2			PLAN 3			PLAN 4			PLAN 5		
	FUNDSIZE '000	ERCOST '000	PCT OF PAY	FUNDSIZE '000	ERCOST '000	PCT OF PAY	FUNDSIZE '000	ERCOST '000	PCT OF PAY	FUNDSIZE '000	ERCOST '000	PCT OF PAY	FUNDSIZE '000	ERCOST '000	PCT OF PAY
1978	0	407	2.51	0	209	1.29	0	213	1.31	0	332	2.05	0	115	.71
1979	854	450	2.73	648	231	1.40	652	235	1.43	775	368	2.23	119	127	.77
1980	1847	485	2.88	1396	250	1.48	1406	254	1.51	1670	397	2.36	259	137	.81
1981	2972	505	2.99	2235	260	1.54	2254	264	1.56	2679	413	2.45	419	142	.84
1982	4165	519	3.06	3117	267	1.58	3149	271	1.60	3743	424	2.50	589	146	.86
1983	5437	529	3.11	4047	272	1.60	4098	277	1.63	4872	432	2.54	768	149	.88
1984	6785	538	3.15	5022	277	1.62	5100	281	1.65	6065	440	2.57	956	152	.89
1985	8210	542	3.18	6041	279	1.64	6155	283	1.66	7322	443	2.60	1152	153	.90
1986	9658	545	3.21	7065	280	1.65	7223	285	1.68	8595	445	2.62	1346	153	.90
1987	11167	547	3.23	8121	281	1.66	8335	286	1.69	9920	447	2.64	1543	154	.91
1988	12733	548	3.25	9206	282	1.67	9489	286	1.70	11294	448	2.65	1740	154	.91
1989	14346	548	3.26	10310	282	1.68	10676	286	1.70	12709	448	2.67	1935	154	.92
1990	15997	541	3.28	11426	279	1.69	11889	283	1.71	14161	443	2.68	2127	153	.92
1991	17590	535	3.29	12484	275	1.69	13058	279	1.72	15563	437	2.69	2302	151	.93
1992	19186	528	3.31	13527	272	1.70	14229	276	1.73	16972	431	2.70	2467	149	.93
1993	20784	521	3.32	14555	268	1.71	15399	272	1.74	18387	426	2.71	2624	147	.94
1994	22381	513	3.33	15568	264	1.72	16569	268	1.74	19805	419	2.72	2771	145	.94
1995	23965	504	3.35	16556	259	1.72	17729	263	1.75	21218	412	2.73	2908	142	.94
1996	25527	495	3.36	17512	255	1.73	18873	259	1.76	22618	405	2.75	3032	139	.95
1997	27065	486	3.37	18438	250	1.73	20000	254	1.76	24003	397	2.76	3146	137	.95
1998	28579	477	3.39	19333	246	1.74	21109	249	1.77	25370	390	2.77	3248	134	.95
1999	30065	467	3.40	20195	240	1.75	22198	244	1.78	26716	382	2.78	3340	132	.96
2000	31509	456	3.41	21016	235	1.75	23257	238	1.78	28027	373	2.79	3420	129	.96
2001	32908	446	3.42	21795	230	1.76	24283	233	1.79	29301	365	2.80	3489	126	.96
2002	34265	435	3.43	22535	224	1.77	25278	227	1.79	30536	355	2.81	3549	123	.97
2003	35570	423	3.45	23231	217	1.77	26236	221	1.80	31723	345	2.82	3598	119	.97
2004	36810	409	3.46	23875	211	1.78	27145	214	1.81	32849	335	2.83	3637	115	.97
2005	37977	396	3.47	24462	204	1.79	28001	207	1.82	33908	324	2.84	3667	112	.98
2006	39066	382	3.49	24991	196	1.79	28799	200	1.82	34891	312	2.85	3687	108	.98
2007	40068	366	3.50	25456	188	1.80	29531	191	1.83	35790	299	2.86	3699	103	.99
2008	40969	349	3.52	25850	180	1.81	30188	183	1.84	36593	285	2.88	3701	98	.99

ADDENDUM TO APPENDIX 4

COMPREHENSIVE ALTERNATIVE PRIVATE PENSION PLANS
SEPTEMBER 1979

James G. Paterson, F.S.A., F.C.I.A.

This addendum to Appendix 4 dated May 26, 1978 summarizes the results of the 'Comprehensive Alternative' runs of the Pension Plan Simulation Model.

1. Actuarial Assumptions and Employee Census Data. The actuarial assumptions and the initial employer census data used in preparing these cost estimates are identical to those described in Section III. The detail on these assumptions and employee data is not contained in this addendum in the interests of brevity.

2. Actuarial Methods. The estimated employer current service costs are presented on the basis of a 'New Entrant' method.

The 'New Entrant' contribution rate is the level rate required to be contributed by the employer to finance the future stream of benefits in respect of new entrants, each joining the plan at age 21. This corresponds closely to the new entrant 'cohort' method (which has been called in the Task Force report, the 'full cost' method) used by the Department of Insurance in preparing, for the information of the Task Force, current service contribution rates for alternative variations of the Canada/Quebec Pension Plans (C/QPP).

3. Terms and Provisions of the Plans. The Comprehensive Alternative plans are of two types, defined benefit and defined contribution. The defined benefit plan is of the 'indexed career average' type where the earnings-related benefit earned each year is indexed to the Industrial Composite average wage index (described in the Task Force report as average wages and salaries or AWS) up to retirement and is indexed to the Consumer Price Index (CPI) after retirement. This is similar to the present CPP indexing of earnings and benefits. Both Comprehensive Alternative plans require employee contributions of 4% of covered earnings minus the contributions made by the employee to the C/QPP.

The defined benefit plan provides a unit of retirement benefit equal to 0.4% of covered earnings up to the Year's Maximum Pensionable Earnings (YMPE) and 1.0% of covered earnings in excess of the YMPE, for each year of service. On death, disability or termination of employment, however, it provides a lump sum payment equal to twice the employee's own contributions with interest. Interest is calculated each year at the full rate of return (or loss) earned by the pension fund.

The defined contribution plan provides a benefit on retirement, death, disability or termination of employment financed by the accumulated employee and employer contributions with interest. Employers match the employee contributions each pay period. Interest is calculated each year at the full rate of return (or loss) earned by the fund.

Full details of the provisions of the two Comprehensive Alternative plans follow:

Eligibility. All employees automatically participate in the plan at age 21.

Service. All service after age 21 is eligible for credit under the plans.

Covered Earnings. All employee earnings up to 150% of the Industrial Composite average wage.

Employee Contributions. 4% of covered earnings, less contributions to the Canada/Quebec Pension Plans (C/QPP).

Normal, Early and Late Retirement. Retirement on a regular (unreduced) pension at age 65. Retirement on a regular (unreduced) pension would be available earlier than age 65 in individual cases of poor health and in those types of employment where there is a general trend among older workers of poor health, reduced life expectancy, inability to properly perform the work required on the job or an increase in the risk to public safety. Early retirement on a reduced pension would be available, at the employee's option, on and after age 55, and earlier in the special cases cited above. Upon early retirement, defined benefit pensions would be reduced by 5% for each year of early retirement.

Pre-Retirement Death Benefit. Refund of two times the employee's own contributions with interest.

Pre-Retirement Disability Benefit. Transfer to a locked-in Registered Retirement Savings Plan (RRSP) of two times the employee's own contributions with interest.

Pre-Retirement Termination of Employment. Full and immediate vesting. Transfer to a locked-in RRSP of two times the employee's own contributions with interest. No deferred pension entitlement.

Normal Form of Pension. All retirement pensions, whether defined benefit or defined contribution, would be payable monthly for the lifetime of the retired employee and the employee's spouse if any, and two-thirds of the pension would continue to the survivor after the death of either the retired employee or the spouse (regardless of who dies first), if prior to retirement the couple had been married for at least one year.

Initial Retirement Pension and Indexing. For defined benefit plans, the earnings of each covered employee for the year would be determined by the employer at the end of each calendar year and the benefit accrued in

the year (0.4% of covered earnings below the YMPE plus 1.0% of covered earnings above the YMPE) would then be calculated. This benefit would be indexed to the "Industrial Composite" average wage up to retirement and would be indexed to the Consumer Price Index after retirement (along the lines of the present CPP indexing of earnings and benefits).

For defined contribution plans, at retirement, the employee's pension account balance (the accumulated employee and employer contributions with interest) would be used to purchase a lifetime pension (indexed with two-thirds continuance to the surviving spouse - either spouse - if married for at least one year prior to retirement).

C/QPP Year's Maximum Pensionable Earnings (YMPE). The annual "Industrial Composite" of average wages and salaries in Canada.

Credited Interest. For benefits to be paid in the case of death, disability or termination of employment prior to retirement under the defined benefit plan, interest would be credited on employee contributions each year at the full rate of return (or loss) earned by the fund.

For purposes of all benefits to be paid under the defined contribution plan, interest would be credited on employee and employer contributions each year at the full rate of return (or loss) earned by the fund.

4. Estimated Costs for Comprehensive Alternative Plans. The estimated cost for current service benefit accruals under the two Comprehensive Alternative plans are shown in Table 1.

Table 1
Estimated Employer Pension Costs for Current Service
For Comprehensive Alternative Private Pension Plans

	Cost as a % of Members' Earnings					
	Defined Contribution Plan			Defined Benefit Plan		
Earnings Base	Employee(2)	Employer	Total	Employee(2)	Employer	Total
			(%)			
Member's Covered Earnings	2.5	2.5	5.0	2.5	2.4	4.9
Members' Total Earnings	2.4	2.4	4.8	2.4	2.3	4.7

Notes:
1. Average rate for the employee group. Individual members would pay varying percentages ranging up to a maximum of almost 4% of their earnings.
2. The above figures have been calculated on a more approximate basis than most of the figures shown in this addendum with the use of a simpler simulation model than the model used to calculate the figures shown in the main part of this appendix.
3. Employer costs determined on the "Attained Age Normal" method (the method used in this appendix to develop the cost estimates for the private sector alternative plans and sensitivity tests) would be slightly higher than the "New Entrant" cost estimates shown here.

5. <u>Effect of Future Changes in C/QPP Contribution Rates</u>. The above figures assume that there is no increase in the present rate of employee contributions under the C/QPP. However, technical analyses indicate that it will be necessary for C/QPP contributions to increase in the future, even if there are no increases in benefits under the C/QPP.

If and when there are future increases in the C/QPP employee contribution rate, it is clear that the employee contribution formula in the Comprehensive Alternative plans would have to change in order to maintain the approximate balance between employer and employee contributions illustrated in Table 1 and to maintain full integration of contributions with the C/QPP. For example, if the C/QPP employee contribution rate were to double (from 1.8 to 3.6%), the employee contribution rate under the Comprehensive Alternative plans would have to change from 4% of earnings minus C/QPP contributions to 5.5% of earnings minus C/QPP contributions to maintain the contribution balance and full integration.

APPENDIX 5

THE LIFETIME IMPACT OF THE RETIREMENT INCOME SYSTEM, A QUANTITATIVE ANALYSIS

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Page

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I. INTRODUCTION

The purpose of this paper is to provide an analysis of the lifetime impact of the main elements of Canada's retirement income system. There are three main questions to which this analysis is directed: how redistributive is the system; will it generate adequate levels of consumption during retirement; and what are the incentives to personal saving for retirement? A lifetime perspective is valuable for such an analysis. Typically, individuals and families make provisions for their retirement during their working years and then draw upon these provisions after they have withdrawn from the work force. Thus, a comprehensive analysis should examine both the working and retirement periods in conjunction with one another.

In order to analyse the retirement income system from this perspective, a model of the typical life cycle economic activity of a single age cohort has been developed. This age cohort will be represented by a set of "typical" families. The point of view being considered is what 18 year olds today can expect from the current retirement income system under idealized conditions of long run stable growth and under the assumption that the retirement income system is mature and unchanging.

II. STRUCTURE OF THE MODEL

A. Overview of the Retirement Income System

The retirement income system in Canada may be viewed as consisting of a number of distinct elements. To begin, there are the federal transfer programs which are conditional on age, the Old Age Security Pension (OAS), and the Guaranteed Income Supplement (GIS) which is also conditional on income. Then there are the national compulsory earnings related pensions, the Canada and Quebec Pension Plans (C/QPP). Employer sponsored pension plans constitute another element, as do individual saving initiatives. Finally, there is a range of provisions in the personal income tax system that is more or less directly related to pensions, retirement, and/or saving for retirement.

The main elements that will be examined explicitly are the following: OAS, GIS, CPP (both contributions and benefits), personal saving, and the personal income tax system. Items not considered explicitly include provincial 'top-up' transfers or tax credits, subsidized housing, health insurance, and employer sponsored pension plans. The program elements are described in somewhat greater detail further below.

B. Life Cycle Demographic Pattern

The model assumes the following 'stylized' pattern for the lifetime demographic structure of a typical family. A single male enters the labour force at age 18 in 1977. He marries a woman of age 23 when he is age 25, has one child at age 26 and a second at age 28. His children leave home when they become 18. He retires at age 65 (in 2024) and dies at age 72. His wife survives him for another eight years (until 2040). The specific figures are parameters of the model and can easily be varied. They have been motivated by the demographic data given in Perspective Canada II (1977, Chapter 2).

In order to assess the impact of the retirement income system on a single age cohort, a set of such typical families will be examined. All of these families are assumed to follow identical demographic patterns, specifically the one just set out. Thus, the model is not very realistic in its portrayal of the variety in demographic patterns that the 1959 birth cohort (those age 18 in 1977) are likely to experience. The basic distinguishing features for this set of otherwise identical families will be their lifetime income, tax, transfer, and consumption profiles.

A more sophisticated analysis that includes realistic demographic transitions is of course feasible, for example using Monte Carlo techniques as in Orcutt et al. (1976), and Pesando and Rea (1977) or the methodology developed in Wolfson (1977). However, for the purposes of this analysis, the simpler approach that has been adopted probably strikes a reasonable balance among the competing concerns over cost, availability of data, flexibility, and robustness of conclusions.

C. Life Cycle Earnings Profiles

In general, there are three main sources of income for families and individuals: earnings, investment income, and transfers. In the model, the earnings patterns have been taken as input; investment income results from personal savings based on the given earnings profiles; and transfers are explicitly simulated in the cases of OAS, GIS, CPP, and family allowances. In this section, the derivation of the earnings profiles is described. In following sections, details are given for the saving function and transfer programs simulated.

Ideally, longitudinal data on family earnings should be used to provide a set of earnings profiles for the model. However, in the absence of such data, the lifetime earnings profiles have been derived from 1974 cross-sectional data on male CPP contributors.(1) Within each of a sequence of five-year age intervals, the earnings distribution has been divided into deciles, and within each age-decile category average earnings have been estimated. Figure 1 displays these age-earnings profiles. Note that the top decile group has been subdivided into two 5% groups (vingtiles). These age-earnings profiles are based on the assumption that a person in the first decile at the beginning of his life remains in the first decile throughout his life, similarly for each other decile and vingtile. This assumption was necessary to infer longitudinal or life cycle earnings patterns from the cross-sectional data that were available. The assumption of no earnings mobility among deciles is, of course, rather stringent. Nevertheless, such an assumption provides a polar case since any mobility would reduce the implied dispersion in lifetime incomes.

The set of 11 lifetime earnings profiles thus represents the age cohort. Clearly, it is quite a simplification to use representative families in this way; but this structure is adequate for an analysis of the broad outlines of the retirement income system from a life cycle

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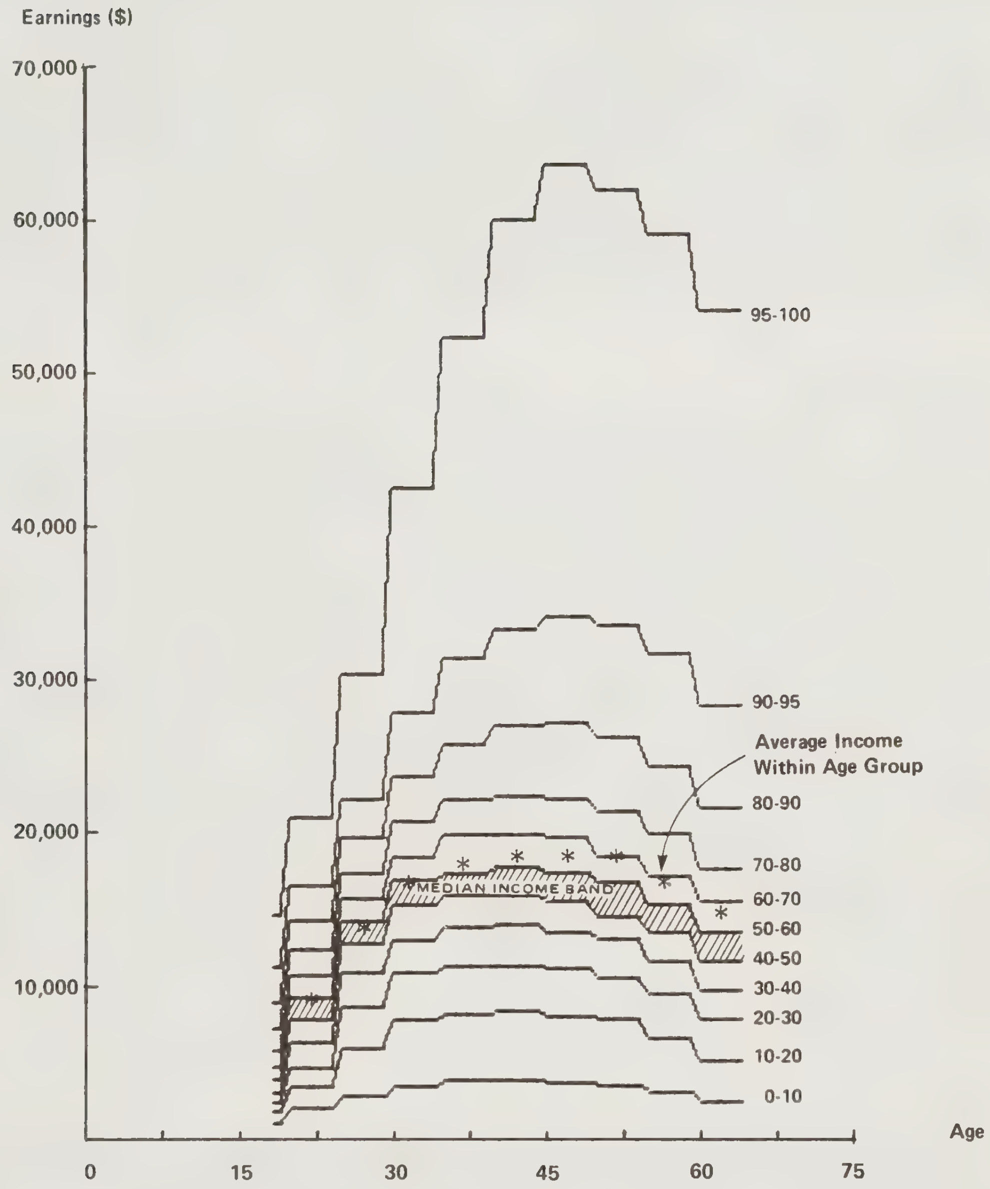
(1)National Health and Welfare, Canada Pension Plan Contributors 1974, Table 13. Female earnings data were not used because expected changes in female labour force participation patterns make projections of female lifetime earnings profiles very hazardous. The model therefore assumes that family lifetime earnings are exactly equal to male lifetime earnings as derived. However, an arbitrary fraction (e.g. one-half) of those earnings can be attributed to the wife. In other words, family lifetime earnings can be arbitrarily allocated to the husband and wife year by year. Then savings, income taxes, and transfer payments can be calculated on an individual basis for each spouse as appropriate.

FIGURE 1

Male Age-Earnings Profiles for Average Earnings and Quantile Groups (%, Nine Deciles, and Top Two Vingtiles), by Five Year Age Group, 1977



Note: All Earnings Inflated by Change in Industrial Composite Wage from 1974 to 1977

perspective. Two additional earnings profiles have been included in the model: the mean and median profiles from the same CPP data source.

The basic focus in the choice of these earnings profiles is on the vertical aspect, stressing the spread or dispersion of the lifetime earnings distribution. An alternative focus which has not been emphasized is the 'shape' of the profiles (e.g. flat or peaked), though as Figure 1 illustrates, not all profiles have the same shape.

One further adjustment that will be made to these age-earnings profiles is to take account of real economic growth. A person 25 years old in 1977 is assumed to earn in 1987 what a 35 year old earned in 1977 inflated by the assumed growth in average real wages over the intervening ten years. The specific growth factor is discussed below.

The set of earnings profiles provides the starting point of the model. In conjunction with a saving function, saving and investment income profiles can be generated. Then, income taxes and transfer payments can be modelled and a lifetime consumption profile determined. Finally, given this collection of profiles for each "typical" family in the age cohort, a set of specially designed statistics and indicators can be computed as the basis for the assessment of lifetime impact that is the object of the analysis.

D. Personal Saving

One of the principal matters of interest in this analysis is the way in which the retirement income system treats personal saving. The model therefore has a simple saving function, based on a set of exogenously given parameters. These parameters include the age at which the family begins saving, a saving rate for earned income and another for investment income during the pre-retirement period. A pattern of drawing down these savings after retirement is also fixed. It can be made equivalent to a joint and survivor life annuity. In addition to the option of not saving at all, the model can simulate six saving strategies representing the main types of portfolio characteristics available. The main differences which characterize these saving strategies are in their treatment by the personal income tax system. A constant pre-tax yield is assumed, independent of the portfolio strategy. In this way, the analysis can focus on the differences in the tax treatment of various types of saving while abstracting from the capital market factors that in practice cause the yields on various types of portfolios to differ. (The saving function is described in greater detail below.)

E. Macro-Economic Assumptions

The model assumes constant exponential growth. The main parameters characterizing the macro-economic assumptions and the basic values that have been used for them in the simulations are: the real pre-tax yield on savings = 3.5%, the real growth rate of average wages and salaries (AWS) = 2.0%, and the rate of price inflation = 0. These values are, of course, stylized and hypothetical; they do not represent

projections. The real yield and real growth rate of wages, however, generally reflect past experience.

Various program elements and tax provisions in the model can be either unindexed, or indexed to changes in prices or wages. In general, these growth variables can be used to generate a range of indexing scenarios. For example, a 'legislated world' would assume the current indexing provisions (though a zero rate of price inflation implies that everything is at least price indexed). This scenario, however, has not been generally used because over the time horizon of the model it has some rather extreme implications. (Recall that the model covers the period from 1977 to 2040.) For example, real wage growth would ultimately push even the bottom decile into the top income tax bracket so long as the income tax system remained only price indexed. Similarly, OAS benefits would be continually shrinking in relation to CPP benefits. To avoid this situation, the basic growth scenario that will be used is the 'relative world' where almost everything is wage indexed. For example, the levels of exemptions and the rate brackets in the income tax system and OAS benefits remain unchanged in relation to average wages for successive age cohorts. However, the capital income base of the tax system (e.g. interest income) has not been explicitly indexed, though it is implicitly indexed to prices when the rate of price inflation is assumed to be zero.

F. The Discount Rate

In order to value the lifetime profiles of income, transfers, and consumption generated by the model, a constant discount rate equal to the growth rate of average wages will be used. The choice of such a discount rate is of course quite problematic. In principle, it is not even clear that a constant discount factor should be used. Insofar as this analysis is addressed at determining the levels and distribution of 'well-being' expected to be generated by the retirement income system, it could be argued than some sort of social welfare function should be used to value the alternative sets of lifetime family consumption profiles generated by the model. Such a social welfare function should probably take some account of the fact that an individual's valuation of an extra dollar of consumption ten years hence would likely depend on whether his total consumption at that time is lavish or at a subsistence level, and whether or not he has any consumption in the intervening years (i.e. his preferences are probably concave and not additively separable). Both of these factors are ignored when a constant discount rate is used. However, this type of constant rate 'social welfare function' is being used for three main reasons: it simplifies the analysis; the results are easier to communicate; and there is insufficient agreement on the specific form that a more appropriate social welfare function should take.

The question remains of what constant discount rate should be used to value lifetime family consumption streams. Three obvious alternatives in the context of the model are zero (i.e. the rate of price inflation), the growth rate of average wages, and the pre-tax yield. Judging by popular discussions of economic matters in the press, one might well conclude that most people have a zero real discount rate, or even a zero nominal discount rate. For example, it is often the case that nominal dollar amounts over several years are simply added together

with no discounting. At the other pole, the federal Treasury Board Secretariat's Benefit-Cost Analysis Guide (1976) recommends discount rates based on the before tax yield on investment.

However, from a social policy perspective it seems most appropriate to adopt the discount rate that embodies a notion of social relativities, namely the growth rate of average wages. This discount rate reflects the assumption that, for example, an individual is equally happy with a given level of OAS benefits from year to year so long as they remain a constant proportion of average wages. This fact presumably matters much more to the individual and hence to assessments of social welfare than the fact that his OAS benefits can buy larger real amounts of consumption per year, or that the increase in his OAS benefit is less than the increase in output the society could realize by deferring consumption one year (the before-tax yield). It is this view of subjective well-being as largely a relative matter that underlies the choice of the growth rate of average wages as the discount rate in the context of the analysis developed here.(2)

G. Description of the Program Elements

1. CPP Contributions. It is assumed that all contributions are borne by the employee. The current rate is 3.6% of earnings between the Year's Basic Exemption (YBE) and the Year's Maximum Pensionable Earnings (YMPE), though 'full cost' contribution rates will generally be assumed. The YMPE is assumed to be $13,200 in 1977, the actual level of the industrial composite wage. (The transitional arrangements have been ignored.) The YBE is set at 10% of average wages (rounded down to the nearest $100) and both the YMPE and YBE are wage indexed.

2. CPP Benefits. CPP benefits are computed according to the present formula. This formula equates benefits with a fraction of adjusted career average earnings. The earnings in the best 85% of the earning years (40 out of 47 given the model's assumptions) are expressed as a fraction of the YMPE in the respective years (to a maximum of one) and these fractions are then averaged to compute adjusted career average earnings. The pension benefit is then 25% of the average of the last three years' YMPE times adjusted career average earnings. A 60% survivor's pension is allowed for the spouse, as well as a death benefit. While the CPP system at present has the pension benefits indexed to prices, to maintain consistency with the relative world indexing scenario these benefits are wage indexed in the model.

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(2) It might also be noted that for some forms of saving, a 3.5% before - tax real yield may imply close to a 2.0% after-tax real yield, though this is coincidental. In standard neo-classical choice theory, it is the after-tax yield that matters for inter-temporal allocations. The following quotes may also be of interest in this context: "... it is assumed that we do not discount later enjoyments in comparison with earlier ones, a practice which is ethically indefensible and arises merely from the weakness of the imagination.." (Ramsay, 1928) and "... the ethical issues presented by the problem of dynamic choice remain basically unanswered if not unanswerable..." (Strotz, 1955).

3. <u>OAS and GIS</u>. The OAS is a flat rate demogrant. Benefits of $1,747 per person in 1977 are credited after age 64 to the husband, and after age 66 (when the wife turns 65) to both spouses. They are wage indexed. Basic GIS benefits are $1,225 for an individual and $2,177 for a couple in 1977. They are reduced (income tested) at a rate of 50% for income from earnings, CPP benefits, investments, and Registered Retirement Savings Plan (RRSP) withdrawals. Spouse's Allowance (a part of the GIS program) is paid during the first two years of retirement. GIS benefits are also wage indexed.

4. <u>Personal Income Taxes</u>. Essentially, all the basic features of the 1977 income tax are included except that the dividend gross up and credit is set at the 1978 level. Assessed income comprises earnings, family allowance (assumed to be wage indexed), OAS, CPP benefits, investment income, and RRSP withdrawals. RRSP and CPP contributions are deductible, as are the basic personal exemptions. Personal exemptions and the rate brackets are assumed to be wage indexed, as are the $5,500 RRSP limit, the $100 standard medical and charitable deduction, and the 9% federal basic tax reduction (minimum $200 plus $50 per child, maximum $500). Also included are the 3% (maximum $250 wage indexed) employment expense deduction, deductible unemployment insurance contributions at 1.5% (maximum $172 wage indexed), and transferability of the age exemption (and the $1000 interest and pension income deductions). Provincial income tax is computed as 44% of federal basic tax (the rate for Ontario in 1977).

5. <u>Federal Other Taxes</u>. The model also computes amounts for all federal taxes paid by each family over its lifetime other than personal income taxes. These amounts are required for some of the measures of lifetime impact described below. The incidence of these other federal taxes is expressed as a proportion of consumption. The actual rates have been derived from an impressionistic interpolation of Gillespie's (1976) figures based on 1969 data. The assumed tax rates (in per cent) for the first nine deciles, top two vingtiles, and the median and mean are 36, 19, 17, 15, 15, 13, 13, 12, 12, 11, 11, 15 and 15 respectively. Thus, the incidence of federal taxes other than personal income taxes is being assumed to be quite regressive. However, it should <u>not</u> be inferred that at present federal other taxes have this incidence pattern. There have been significant changes in federal taxes since 1969 and there remain some concerns regarding Gillespie's estimation method.

H. <u>Measures of Lifetime Impact</u>

1. <u>Basic Variables</u>. Given the program elements and data inputs defined above, the model generates lifetime variables for each of the 13 hypothetical families (nine deciles, two vingtiles, mean, and median). The basic variables generated by the model and displayed in subsequent tables are:

EARN - total family earnings pre-retirement

PRESAV - the net pre-tax pre-retirement impact of savings on consumption

CPPC - CPP pre-retirement contributions

PRETPTX- federal plus provincial personal pre-retirement income taxes

PRECON - pre-retirement consumption, equals earnings (EARN) + family allowance - (net savings (PRESAV) + CPP contributions (CPPC) + total income taxes (PRETPTX) + unemployment insurance contributions + work related expenses assumed to be 5% of earnings); gross of federal other taxes

PUBRETC- public retirement contributions, essentially the amount of federal taxes that would have to be earmarked to finance the cohort's public retirement benefits (see below)

OAS - OAS post-retirement benefits

GIS - GIS and Spouse's Allowance post-retirement benefits

CPPB - CPP post-retirement benefits

TFTRAN - total federal transfers, equals OAS + GIS + CPPB

RETSAV - net pre-tax increment to post-retirement consumption due to dis-saving out of accumulated wealth, includes investment income consumed

RETTPTX- federal plus provincial personal income taxes post-retirement

RETCON - post-retirement consumption, equals OAS + CPP benefits + GIS and Spouse's Allowance + net dis-saving (RETSAV) - total income taxes (RETTPTX); gross of federal other taxes

CONS - pre- and post-retirement consumption

FPTX - pre- and post-retirement federal personal income taxes

PPTX - pre- and post-retirement provincial personal income taxes

FOTX - federal other taxes paid, included in consumption

For each of these variables, a vector is generated by the model, giving the age profile over the entire lifetime of the family. In general, the analysis will be based on the present discounted value (PDV) of each of these vectors (using the discount rate equal to the growth rate of average wages) expressed as an annual rate. For example, there are 47 pre-retirement years so that if the PDV of earnings were $470,000,

the PDV of EARN at annual rates would be $10,000. The following table indicates the time period over which the annual rates have been computed for each variable:

Pre-Retirement (47 years)	Post-Retirement (16 years)	Lifetime (63 years)
EARN	OAS	CONS
PRESAV	GIS	FPTX
CPPC	CPPB	PPTX
PRETPTX	TFTRAN	FOTX
PRECON	RETSAV	
PUBRETC	RETTPTX	

It is now possible to define the variable PUBRETC. Given the PDVs of the above variables for each of the nine deciles and two vingtiles, the aggregate cost (in present discounted value terms) for this cohort of their CPP, OAS, and GIS benefits can be computed. It is simply the weighted sum of the lifetime costs of the three programs for each of these 11 hypothetical families with a weight of .10 for each of the nine deciles and a weight of .05 for each of the two vingtiles. Similarly, it is possible to compute the cohort's aggregate payments of CPP contributions (CPPC), federal personal income tax (FPTX), and federal other tax (FOTX). It is then possible to express the aggregate lifetime benefit costs as a share of total federal taxes (FPTX + FOTX). For example, it could turn out that for the cohort as a whole, the PDV of OAS benefits was 6% of the PDV of total federal taxes. If it is assumed that the cohort is going to pay for its own federal retirement benefits by earmarking the appropriate proportion of its own federal tax payments, this proportion will be the ratio of the weighted sum of the PDVs of CPPB + OAS + GIS - CPPC to the weighted sum of the PDVs of FPTX + FOTX (before annualizing any of the PDVs). Call this proportion p. Then the contribution any <u>one</u> of the 11 representative families within the cohort notionally makes to financing its own retirement benefits is given by the following formula:

$$\text{PUBRETC} = \text{CPPC} + p(\text{FPTX} + \text{FOTX})$$

Given these basic variables, a range of indicators can be constructed showing various facets of the lifetime impact of the retirement income system. The focus here will be on three main facets: redistribution, adequacy, and the returns to saving.

2. <u>Redistributive Impact</u>. Perhaps the simplest indication of redistribution is a comparison of the shares of various retirement income benefits accruing to the different income deciles and vingtiles. For example, it is to be expected that a larger share of GIS benefits would accrue to the lower income groups while the shares of OAS benefits would equal the population shares (10% for deciles and 5% for vingtiles). By this 'absolute' comparison, then, GIS is redistributive, OAS is distributionally neutral, and CPP benefits are absolutely regressive.

However, this type of indicator has two main limitations. First, no account is taken of contributions and income taxes paid; and second, no account is taken of the extent of prior 'exogenous' inequality as manifested by unequal shares of lifetime earnings. One way to overcome these two limitations is to compare net pre- and post-redistribution inequality, where all such items are considered. This can be done easily with the model by comparing, for each decile or vingtile, its share of lifetime earnings to its share of lifetime consumption. The net impact of the system of taxes and transfers would then be 'relatively' redistributive in lifetime terms if, for lower income groups, their consumption share was larger than their earnings share.(3)

One problem in measuring lifetime redistribution for a cohort is that in reality, there are also likely to be significant amounts of redistribution between age cohorts or generations. The intention here is to abstract from inter-generational redistribution. To do so, the model simulations typically assume that the CPP contribution rate has been set at a level such that the cohort's contributions exactly match its benefits in present discounted value terms; and the PUBRETC variable has been defined in the way it has.

One issue is again the choice of discount rate to be used to determine when the CPP is fully funded, and to determine the appropriate fraction of federal taxes to be earmarked for public retirement contributions (PUBRETC). The point of view adopted here is that for sorting out matters of inter-generational or inter-cohort transfers, the growth rate of average wages provides the appropriate discount factor. In other words, when an age cohort or generation is making a judgment about whether the contributions or taxes it paid during its working years are commensurate or fair in relation to the benefits it receives during retirement, the appropriate yardstick to be used is the value of those taxes and benefits as a proportion of average wages.

Given these assumptions for defining a situation of no inter-cohort redistribution, it is possible to construct a further indicator of the (intra-cohort) redistributive impact. This indicator is simply the ratio of what each decile or vingtile income group gets (TFTRAN, not annualized) to what it pays (PUBRETC, not annualized). For example, if lower income groups receive more in GIS, OAS, and CPP benefits than they pay in CPP contributions and notionally earmarked taxes, then their 'benefit-cost' ratio will exceed one. Since the benefit-cost ratio for the cohort overall has been defined to be one, upper income groups will in turn have benefit-cost ratios below one, indicating that the system is broadly redistributive.

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(3)Pesando and Rea (1977) use only the absolute apporach to measuring redistribution. However, it is the relative approach that is consistent with the Lorenz criterion that is widely accepted in the literature on the measurement of inequality (Atkinson, 1970). Nevertheless, we do agree with Pesando and Rea in their rejection of the internal rate of return as an appropriate indicator of the redistributive impact of public pension systems.

3. Adequacy. The usual approach to measuring the adequacy of a given income is to compare it to a poverty line standard such as those produced by the Canadian Council on Social Development or Statistics Canada. It is possible to make such an assessment using the model by examining the annualized PDV of post-retirement consumption, RETCON.(4) However, this measure omits a very important perspective, namely that of 'continuity of consumption'. From this perspective, the central question is how post-retirement consumption compares to pre-retirement consumption. This comparison can be easily expressed within the model by the ratio of annualized RETCON to annualized PRECON. This ratio will be used as the basic indicator of retirement consumption adequacy.

Although this ratio is simply computed, the underlying concept of continuity of consumption is not so straightforward. Several assumptions are implicit in the specific ratio being used, assumptions on which there may not be unanimous agreement. Three of these assumptions concern (1) the discount rate chosen, (2) the particular pre-retirement years whose consumption is being considered, and (3) the particular post-retirement years being considered. Whether or not a given consumption stream represents continuity of consumption (i.e. a ratio of annualized RETCON to annualized PRECON close to one) is highly sensitive to the discount rate. A consumption stream that appears highly adequate when the real discount rate is zero could appear seriously inadequate when the real discount rate equals the real yield. However, the argument given above for choosing a discount rate equal to the growth rate of average wages is also applicable for assessing continuity of consumption. Thus, a discount rate equal to the growth rate of average wages has been used.

There are also alternatives for the choice of years to be considered both pre- and post-retirement. The CPP allows a 'drop-out' of a number of the lowest earning years while many employer sponsored pension plans base their benefits on the pay received during the last several years of a person's career. These alternative earnings bases in pension plans have obvious analogues for pre-retirement consumption bases. For example, the last ten or best five pre-retirement years' consumption could be averaged to provide the denominator for the continuity of consumption ratio. Similarly, post-retirement consumption in only the first year could be used for the numerator of the ratio. In that case, the particular type of post-retirement indexing of benefits would not matter. However, the ratios used in this analysis will be based on consumption in all pre- and post-retirement years.

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(4)It should be recalled that post-retirement consumption is averaged over the entire retirement period during only half of which both spouses are alive. Since the discount rate equals the growth rate of average wages, a comparison of RETCON to some poverty line corresponds to the view that poverty is a relative rather than an absolute phenomenon.

One further issue in the definition of continuity of consumption concerns variations in family size over the life cycle. Clearly, $10,000 of consumption for a single individual makes him better off than a family of four also with $10,000 of consumption. One way to take account of this is to adjust consumption explicitly in relation to family size. Two approaches to this issue have been incorporated in the model. In the first, an absolute adjustment is made. In every year that two adults are present, consumption is reduced by $1,200 (wage indexed), and consumption is further reduced by $600 (also wage indexed) for every child under age 18 present. These figures are based roughly on current differentials in welfare benefits by family size. Continuity of consumption ratios are then computed after these absolute family size adjustments have been made.

The second method is based on a relative family size adjustment. Instead of using actual consumption, consumption is first expressed in 'per equivalent adult unit' (EAU) terms. A single individual is considered as one EAU, while a couple with no children is considered as 1.67 EAUs. Each child then counts as an additional 0.33 EAU. (These figures are the same as those used by the Canadian Council on Social Development in the construction of their poverty lines.) Thus, during that portion of the family's life cycle when the couple has both children at home, consumption would be divided by 2.33 before computing the continuity of consumption ratio.

Both the absolute and relative family size adjustments described above are admittedly fairly rough, and they may lead to significantly different changes to the 'raw' continuity of consumption ratio. Nevertheless, some adjustment is important from a social policy perspective. Furthermore, there are some grounds for supposing that the absolute family size adjustment may be more appropriate. Essentially, the relative family size adjustment is based on the premise that adding another member to a family creates a proportionate increase in 'needs' independent of the level of the family's income or consumption. However, it is more likely that adding a family member has an element of 'fixed costs'. Thus, above a certain level of consumption, proportionate increases in consumption as a consequence of the additional family member would probably be viewed by many as an increase in consumption greater than that required to leave the family 'equally well off'. For example, a 67% increase in consumption for an individual originally consuming $50,000 annually who then gets married likely involves a significant increase in the couple's well-being, especially given that recent welfare benefit levels have embodied the view that the basic needs of a spouse amounted to about $1,200 per year.

To summarize, the main indicator of adequacy that will be used is the continuity of consumption ratio. This ratio is computed as the ratio of the annualized PDVs of post- to pre-retirement consumption, taking all years into account. The discount rate, as elsewhere in the analysis, equals the growth rate of average wages. This basic ratio has been modified to produce two further ratios embodying either an absolute or relative adjustment to take account of changes in family composition over the life cycle.

4. Returns to Saving. To the extent that the retirement income system in Canada today encourages personal saving for retirement, a fundamental question concerns how much net return there is to saving. The most obvious measure in this case is the real after-tax, after-transfer rate of return. This measure is computed in the model as the internal rate of return to the difference in two alternative lifetime consumption streams, one with some type of saving and the other from another simulation run of the model similar in every respect except that there is no saving. Then, insofar as the tax and transfer treatment of saving varies by income class, this will be reflected in different net rates of return. The distributional impact of different saving provisions will also be revealed by different levels of the PDV of lifetime consumption (CONS), as well as different shares of CONS and different continuity of consumption ratios by decile and vingtile.

III. SIMULATION RESULTS

A. Redistributive Impact and Adequacy

1. Base Case. Table 1 displays the main output from the base case simulation run. Each column of the table corresponds to a given representative lifetime income group, for the nine deciles, two top vingtiles, the median and the mean. Each group of rows presents statistics for the given variable. (Total post-retirement income taxes (RETTPTX) do not appear in Table 1 because they are zero for everyone.) The first row in each group of rows gives the variable name and the annualized PDVs in thousands of dollars. The second row in each group of rows, preceded by the row label 'S', gives the shares of the item accruing to each income group. For example, the share of lifetime earnings accruing to the fourth decile ("30-40") is 7.3%. In some groups of rows, there is a third row preceded by the row label 'C'. This row gives the ratio of the variable in question to pre-retirement consumption. For example, in the fourth decile again, OAS benefits equal 27.2% of PRECON (both annualized) and total post-retirement consumption (RETCON) equals 61.8% of PRECON, which is also the unadjusted continuity of consumption indicator. Finally, there are four special rows as follows:

Variable	Row Label	Definition
CPPB	CPPC	the ratio of CPP benefits to CPP contributions (both un-annualized)
TFTRAN	PUBRETC	the ratio of TFTRAN to PUBRETC (both un-annualized)
RETCON	FS-R	the ratio of RETCON to PRECON (both annualized) where both incorporate the relative family size adjustment
RETCON	FS-A	the corresponding ratio incorporating the absolute family size adjustment

The basic conclusion derived from Table 1 is that in broad outline the system is substantially redistributive. While the poorest two deciles have 2.0 and 4.3% of the lifetime earnings, they have 3.5 and 5.8% of the lifetime consumption, respectively. At the same time, the top two vingtiles have 9.0 and 15.4% of the lifetime earnings and 7.9 and 11.4% of the lifetime consumption of the cohort. Using another indicator, total federal transfers received during retirement (TFTRAN) by the poorest two deciles were about 2.6 and 2.0 times their public retirement contributions (PUBRETC), compared to 0.64 and 0.37 for the top two vingtiles. This redistributive impact is primarily due to the flat rate OAS, the income tested GIS, and the progressive personal income tax. Note that without any saving and with wage indexing of GIS and CPP benefits, all couples are eligible for some GIS, since the maximum CPP benefit remains below the GIS breakeven. Note also that a 'mature' CPP with a 'full cost' contribution rate of 8.1% is being assumed.(5)

(5)Recall that this full cost contribution rate was computed using a 2% real discount rate. Furthermore, since the model was not designed to provide estimates of the full cost contribution rate, the figure 8.1% should be treated with caution.

Key to Tables 1 to 4

Horizontal Axis: lifetime income profiles - nine deciles, two vingtiles, mean, and median (based on earnings of 1974 CPP contributors)

Vertical Axis Main Variables:

EARN - total family earnings pre-retirement
CPPC - Canada Pension Plan pre-retirement contributions
PRETPTX - total pre-retirement personal income tax
PRECON - pre-retirement consumption
PUBRETC - public retirement contributions (defined in text)
OAS - Old Age Security benefits post-retirement
GIS - Guaranteed Income Supplement and Spouse's Allowance benefits post-retirement
CPPB - Canada Pension Plan post-retirement benefits
TFTRAN - total federal transfers post-retirement
RETTPTX - total post-retirement personal income tax
RETCON - post-retirement consumption
CONS - lifetime consumption
FPTX - lifetime federal personal income tax
PPTX - lifetime provincial personal income tax
FOTX - lifetime federal other tax

Vertical Axis, Details of Specific Rows:

First Row for Each Variable - present dicounted value (PDV) at annual rates ($000s)

'S' Row - fraction of aggregate amount for cohort accruing to given decile or vingtile

'C' Row - ratio of annualized PDV of main variable to annualized PDV of PRECON

CPPC row under CPPB - ratio of unannualized PDV of CPPB to unannualized PDV of CPPC
PUBRETC row under TFTRAN - ratio of unannualized PDV of TFTRAN to unannualized PDV of PUBRETC

FS-R row under RETCON - relative family size adjusted continuity of consumption ratio

FS-A row under RETCON - absolute family size adjusted continuity of consumption ratio

TABLE 1

Base Case Simulation, Selected Variables by Lifetime Income Profile

(see key to Tables for description of variables and format)

PRESENT DISCOUNTED VALUES AT ANNUAL RATES ($000'S)

	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-95	95-100	MEDIAN	MEAN
EARN	3.08	6.61	9.25	11.38	13.20	14.92	16.79	19.06	22.64	27.97	47.84	14.11	15.48
S	.020	.043	.060	.073	.085	.096	.108	.123	.146	.090	.154		
CPPC	.15	.43	.65	.80	.87	.90	.92	.94	.95	.96	.96	.89	.90
S	.019	.057	.085	.106	.115	.119	.121	.124	.126	.063	.064		
PREIPTX	.00	.17	.71	1.23	1.72	2.22	2.79	3.54	4.84	7.11	16.85	1.98	2.40
S	.000	.006	.024	.042	.059	.076	.096	.121	.166	.122	.288		
PRECON	2.95	5.79	7.52	8.84	10.01	11.11	12.29	13.68	15.77	18.55	27.68	10.60	11.47
S	.027	.052	.068	.080	.090	.100	.111	.123	.142	.084	.125		
PUBRETC	.61	.86	1.22	1.48	1.69	1.80	1.97	2.14	2.47	2.95	5.16	1.79	1.92
S	.033	.047	.067	.081	.093	.098	.108	.117	.135	.081	.141		
OAS	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
S	.100	.100	.100	.100	.100	.100	.100	.100	.100	.050	.050		
C	.813	.415	.320	.272	.240	.216	.195	.176	.152	.129	.087	.227	.210
GIS	1.56	1.14	.83	.63	.56	.54	.54	.54	.54	.54	.54	.55	.54
S	.210	.153	.112	.085	.076	.073	.073	.073	.073	.036	.036		
C	.529	.197	.111	.071	.056	.049	.044	.040	.034	.029	.020	.052	.047
CPPB	.66	1.45	2.03	2.43	2.57	2.62	2.62	2.62	2.62	2.62	2.62	2.61	2.62
S	.030	.065	.091	.109	.115	.118	.118	.118	.118	.059	.059		
C	.225	.250	.270	.275	.257	.236	.213	.192	.166	.141	.095	.246	.229
CPPC	1.545	1.144	1.071	1.032	1.008	.989	.971	.951	.939	.932	.925	.998	.990
TETRAN	4.63	4.99	5.26	5.46	5.54	5.56	5.56	5.56	5.56	5.56	5.56	5.56	5.56
S	.086	.093	.098	.102	.103	.104	.104	.104	.104	.052	.052		
C	1.567	.861	.700	.618	.553	.501	.453	.407	.353	.300	.201	.524	.485
PUBRETC	2.591	1.984	1.473	1.256	1.114	1.054	.963	.886	.767	.641	.367	1.057	.987
RETCON	4.63	4.99	5.26	5.46	5.53	5.56	5.56	5.56	5.56	5.56	5.56	5.55	5.56
S	.086	.093	.098	.102	.103	.104	.104	.104	.104	.052	.052		
C	1.567	.861	.700	.618	.553	.501	.453	.407	.353	.300	.201	.524	.485
FS-R	2.113	1.168	.945	.831	.741	.668	.602	.539	.467	.395	.266	.700	.646
FS-A	2.734	1.018	.773	.661	.578	.515	.459	.407	.347	.291	.189	.544	.497
CONS	3.38	5.59	6.94	7.98	8.88	9.70	10.58	11.62	13.17	15.25	22.06	9.32	9.97
S	.035	.058	.072	.083	.092	.101	.110	.120	.137	.079	.114		
FPTX	.00	.06	.32	.59	.84	1.10	1.39	1.77	2.43	3.58	8.62	.97	1.19
S	.000	.004	.022	.041	.058	.075	.095	.121	.166	.123	.295		
PPTX	.00	.07	.21	.33	.44	.56	.69	.87	1.19	1.72	3.95	.50	.60
S	.000	.010	.029	.045	.061	.078	.097	.121	.165	.120	.275		
FOTX	1.22	1.06	1.18	1.20	1.33	1.26	1.38	1.39	1.58	1.68	2.43	1.40	1.49
S	.089	.078	.086	.088	.098	.092	.101	.102	.116	.061	.089		

This basic conclusion is subject to several caveats. First, this is only a partial incidence analysis. For example, federal other taxes are only considered indirectly (via PUBRETC) and other programs such as health insurance are not considered at all. Second, personal income taxes paid will in general have a somewhat different distribution than that indicated because of various credits, deductions, and exemptions not considered explicitly (for example, childcare and moving expenses and the political contribution credit). A third factor relates to saving, which will be examined below. Finally, while the model incorporates a range of incomes, only a single 'typical' demographic profile has been considered. Nevertheless, these caveats should not affect the general results.

Turning to a more detailed examination, it is evident that all three of the basic federal programs are redistributive, GIS and Spouse's Allowance having the greatest redistributive impact and CPP the smallest. This assertion applies to the benefits alone when compared to earnings. For example, the share of CPP benefits accruing to the lower income groups exceeds their share of lifetime wages even though the benefits increase with income in absolute terms. However, the GIS and OAS shares are even larger. This assertion also applies to the benefits in relation to their associated lifetime 'contributions'. CPP benefits are over 1.5 times the value of CPP contributions for the bottom decile, and this ratio declines with rising incomes. The main factor here is the YBE. However, OAS and GIS benefits in relation to PUBRETC are even larger for the lower income deciles.

With respect to adequacy in the sense of continuity of consumption, the simulation results indicate that the retirement income system, in the absence of any saving, is adequate or more than adequate only for the bottom two or three deciles, depending on the type of family size adjustment. The system looks best under the relative family size adjustment. Nevertheless, the top half of the income spectrum still experiences a drop in consumption of from 33% to over 70% after retirement.

In order to explore the sensitivity of the above results to several key assumptions, three further simulations will be presented. These simulations illustrate the impact of price rather than wage indexing, two earners in the family, and the discount rate.

2. <u>Price Indexing</u>. Table 2 presents output for the model when the current price indexing provisions are assumed rather than wage indexing, and inflation is assumed to be zero. All the items in the base run that were wage indexed, except earnings themselves and the YMPE (and YBE) in the CPP, are here assumed to be price indexed. As is evident from the shares of TFTRAN in relation to EARN, and the ratio of TFTRAN to PUBRETC, the basic conclusion that the system is broadly redistributive is not affected by the amended type of indexing. However, the extent of redistribution is clearly reduced under price indexing of benefits and taxes, as a consequence of the major relative shifts in the composition of government activity. The share of lifetime consumption of the bottom two deciles is 5 to 10% lower with price indexing. Furthermore, lifetime consumption for everyone is lower by from 15 to 33%. This is the combined

TABLE 2

Simulation Using Price Indexing Rather Than Wage Indexing, Selected Variables by Lifetime Income Profile

(see key to Tables for description of variables and format)

PRESENT DISCOUNTED VALUES AT ANNUAL RATES ($000'S)

	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-95	95-100	MEDIAN	MEAN
EARN	3.08	6.61	9.25	11.38	13.20	14.92	16.79	19.06	22.64	27.97	47.84	14.11	15.48
S	.020	.043	.060	.073	.085	.096	.108	.123	.146	.090	.154		
CPPC	.13	.38	.57	.71	.77	.80	.81	.83	.84	.85	.86	.79	.80
S	.019	.057	.085	.106	.115	.119	.121	.124	.126	.063	.064		
PRETPTX	.02	.69	1.39	2.03	2.65	3.32	4.09	5.07	6.77	9.43	20.58	3.00	3.59
S	.000	.017	.034	.049	.065	.081	.100	.124	.165	.115	.251		
PRECON	2.89	5.28	6.89	8.12	9.17	10.11	11.09	12.25	13.94	16.34	24.05	9.67	10.37
S	.029	.053	.069	.081	.092	.101	.111	.123	.139	.082	.120		
PUBRETC	.22	.49	.73	.90	1.00	1.05	1.11	1.18	1.28	1.43	2.02	1.04	1.08
S	.022	.051	.075	.093	.103	.109	.115	.122	.133	.074	.104		
OAS	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83	.83
S	.100	.100	.100	.100	.100	.100	.100	.100	.100	.050	.050		
C	.288	.158	.121	.102	.091	.082	.075	.068	.060	.051	.035	.086	.080
GIS	.36	.06	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
S	.843	.129	.028	.000	.000	.000	.000	.000	.000	.000	.000		
C	.125	.010	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
CPPB	.59	1.28	1.79	2.15	2.28	2.32	2.32	2.32	2.32	2.32	2.32	2.31	2.32
S	.030	.065	.091	.109	.116	.118	.118	.118	.118	.059	.059		
C	.203	.242	.260	.265	.248	.230	.209	.190	.167	.142	.097	.239	.224
CPPC	1.538	1.139	1.066	1.031	1.008	.989	.971	.951	.939	.932	.925	.998	.990
RETRAN	1.78	2.17	2.63	2.98	3.11	3.16	3.16	3.16	3.16	3.16	3.16	3.14	3.16
S	.063	.076	.093	.105	.109	.111	.111	.111	.111	.055	.055		
C	.616	.410	.383	.367	.339	.312	.285	.258	.226	.193	.131	.325	.304
PUBRETC	2.802	1.502	1.235	1.130	1.061	1.019	.964	.911	.836	.754	.531	1.030	.991
RETTPTX	.00	.01	.07	.16	.19	.20	.20	.20	.20	.20	.20	.20	.20
S	.000	.007	.047	.110	.132	.141	.141	.141	.141	.070	.070		
C	.000	.002	.010	.019	.021	.020	.018	.016	.014	.012	.008	.021	.019
RETCON	1.78	2.16	2.57	2.83	2.92	2.95	2.95	2.95	2.95	2.95	2.95	2.94	2.95
S	.066	.080	.095	.105	.108	.109	.109	.109	.109	.055	.055		
C	.616	.408	.373	.348	.318	.292	.266	.241	.212	.181	.123	.304	.285
FS-R	.814	.543	.496	.462	.421	.384	.349	.314	.276	.235	.160	.401	.374
FS-A	.839	.410	.364	.335	.302	.273	.245	.219	.189	.158	.104	.286	.265
CONS	2.61	4.49	5.79	6.78	7.58	8.29	9.02	9.89	11.15	12.94	18.70	7.96	8.49
S	.032	.055	.071	.083	.093	.102	.111	.121	.137	.079	.115		
FPTX	.00	.33	.69	1.03	1.35	1.69	2.09	2.60	3.48	4.85	10.62	1.53	1.83
S	.000	.016	.033	.049	.064	.081	.100	.124	.166	.115	.253		
PPTX	.01	.18	.36	.52	.68	.83	1.01	1.24	1.63	2.24	4.78	.76	.90
S	.001	.018	.036	.052	.068	.084	.102	.124	.163	.112	.239		
ROTA	.94	.85	.98	1.02	1.14	1.08	1.17	1.19	1.34	1.42	2.06	1.19	1.27
S	.082	.074	.086	.089	.099	.094	.102	.104	.117	.062	.090		

result of higher income taxes and lower transfer benefits.(6) It may also be noted that with OAS and GIS price indexed, while CPP continues to be effectively wage indexed pre-retirement, only the bottom three deciles receive any GIS.

3. Two Earner Family. In Table 3, output from another simulation is presented. The parameters of the model are identical to the base run in every respect except that, during the pre-retirement years when there are two spouses present, it is assumed that the family's earnings are split equally between the husband and wife. This assumption clearly has no effect on the family's lifetime earnings. However, CPP contributions are affected even though the contribution rate has not been changed. For the first four deciles, contributions are lowered since they can effectively claim two YBEs. For the upper six deciles, though, CPP contributions are higher, since the family's YMPE is effectively doubled. Having two earners in each of the representative families has the further effect of lowering income tax liabilities for all income groups, despite the fact that the first four deciles have lower deductible CPP contributions. The net effect is higher pre-retirement consumption for all income groups.

In the post-retirement period, OAS benefits are unchanged but CPP benefits are higher for all income groups, especially the upper deciles. For the lower deciles, the increase in benefits is not the result of a higher pre-retirement earnings base; otherwise contributions would have had to increase. Rather, it is a consequence of the survivorship provisions. With only one earner, the surviving spouse receives a CPP benefit equal to 60% of the benefits the other was receiving for the first part of the retirement period. (Recall that the husband is assumed to live eight and the wife sixteen years after retirement.) When there are two earners, CPP benefits are the same for the first eight years; but during the last eight years the wife continues to get her full (half) pension plus 60% of her husband's (half) pension so that benefits drop by only 20% rather than by 40% as in the one earner case. In addition, for the upper income groups, having two earners effectively doubles their pre-retirement earnings ceiling thereby doubling their post-retirement benefits.

As a result of these higher CPP benefits, GIS benefits are lower for everyone. There is a slight exception to this for the second and third deciles. The explanation in this case is that during the first two years of retirement, the wife is not yet receiving her CPP benefits so the family's Spouse's Allowance benefits are higher. Several other points in Table 3 are worth noting. The higher CPP benefits are sufficient to make all but the bottom three deciles taxable at some point during their retirement (RETTPTX). The CPP is no longer self-financing at the 8.1% assumed contribution rate, as the ratios of lifetime CPP benefits to lifetime contributions for all income groups exceed one. Also, the reduction in aggregate lifetime GIS benefits is much less than

(6) In fact, lifetime OAS plus GIS benefits amount to 6.9% of lifetime federal (income plus other) taxes with price indexing. With wage indexing, the corresponding figure is 28.3%. Also, with price indexing of post-retirement benefits, the full cost CPP contribution rate drops from about 8.1% to about 7.2%.

TABLE 3

Simulation Assuming Earnings Split Evenly Between Spouses, Selected Variables by Lifetime Income Profile

(see key to Tables for description of variables and format)

PRESENT DISCOUNTED VALUES AT ANNUAL RATES ($000'S)

	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-95	95-100	MEDIAN	MEAN
EARN	3.08	6.61	9.25	11.38	13.20	14.92	16.79	19.06	22.64	27.97	47.84	14.11	15.48
S	.020	.043	.060	.073	.085	.096	.108	.123	.146	.090	.154		
CPPC	.06	.34	.56	.73	.88	1.02	1.17	1.35	1.62	1.74	1.79	.95	1.06
S	.006	.036	.059	.077	.092	.107	.123	.142	.171	.092	.094		
PRETPTX	.00	.06	.37	.80	1.20	1.60	2.06	2.63	3.59	5.21	12.83	1.41	1.74
S	.000	.003	.017	.037	.056	.075	.096	.123	.168	.122	.301		
PRECON	3.04	6.00	7.95	9.33	10.48	11.55	12.69	14.07	16.21	19.52	30.72	11.05	11.89
S	.026	.052	.068	.080	.090	.099	.109	.121	.139	.084	.132		
PUBBETC	.64	.86	1.19	1.47	1.78	1.99	2.31	2.64	3.25	3.83	6.12	1.94	2.18
S	.030	.041	.056	.070	.085	.094	.109	.125	.154	.091	.145		
OAS	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40
S	.100	.100	.100	.100	.100	.100	.100	.100	.100	.050	.050		
C	.790	.400	.302	.257	.229	.208	.189	.171	.148	.123	.078	.217	.202
GIS	1.55	1.14	.84	.60	.47	.36	.28	.26	.24	.22	.22	.41	.35
S	.260	.192	.140	.102	.078	.061	.047	.043	.040	.018	.018		
C	.509	.191	.105	.065	.045	.031	.022	.018	.015	.011	.007	.037	.030
CPPB	.71	1.50	2.10	2.58	3.01	3.43	3.85	4.37	5.04	5.42	5.48	3.25	3.50
S	.022	.047	.065	.080	.094	.107	.120	.136	.157	.085	.085		
C	.234	.249	.264	.276	.287	.297	.304	.310	.311	.278	.178	.294	.294
CPPC	4.150	1.489	1.284	1.206	1.169	1.151	1.125	1.101	1.060	1.060	1.044	1.165	1.124
LFTRAN	4.66	5.04	5.34	5.59	5.88	6.20	6.53	7.03	7.68	8.05	8.10	6.06	6.26
S	.075	.081	.086	.090	.095	.100	.105	.113	.124	.065	.065		
C	1.533	.841	.671	.599	.561	.537	.515	.499	.474	.412	.264	.548	.526
PUBBETC	2.473	2.007	1.525	1.291	1.121	1.062	.964	.905	.804	.714	.450	1.062	.977
RETTPTX	.00	.00	.00	.01	.01	.03	.06	.11	.21	.27	.28	.02	.04
S	.000	.000	.001	.009	.020	.047	.082	.158	.297	.190	.196		
C	.000	.000	.000	.001	.001	.003	.005	.008	.013	.014	.009	.002	.003
RETCON	4.66	5.04	5.34	5.58	5.86	6.17	6.47	6.91	7.47	7.77	7.82	6.04	6.22
S	.076	.082	.087	.091	.096	.101	.106	.113	.122	.063	.064		
C	1.533	.841	.671	.598	.559	.534	.510	.491	.461	.398	.254	.546	.523
FS-R	2.079	1.152	.919	.818	.767	.732	.700	.673	.631	.545	.351	.749	.717
FS-A	2.603	.983	.732	.634	.585	.553	.524	.502	.466	.398	.247	.568	.539
CONS	3.45	5.76	7.28	8.38	9.31	10.18	11.11	12.25	13.99	16.54	24.91	9.78	10.45
S	.034	.056	.071	.082	.091	.099	.108	.120	.137	.081	.122		
FPTX	.00	.00	.12	.33	.54	.75	.98	1.29	1.80	2.64	6.50	.65	.82
S	.000	.000	.011	.032	.052	.072	.095	.124	.173	.127	.313		
PPTX	.00	.04	.16	.27	.36	.46	.57	.70	.93	1.32	3.15	.41	.49
S	.000	.008	.028	.046	.063	.080	.099	.123	.163	.115	.275		
FOTX	1.24	1.09	1.24	1.26	1.40	1.32	1.44	1.47	1.68	1.82	2.74	1.47	1.57
S	.086	.076	.086	.087	.097	.092	.100	.102	.116	.063	.095		

the increase in aggregate lifetime CPP benefits. Since tax rates have not been adjusted, the net effect is higher lifetime consumption, concentrated in the top decile at the expense of the bottom seven deciles, and a smaller share of lifetime taxes left over after providing for OAS, GIS, and the shortfall in CPP contributions (65.0% versus 71.7%).

4. Discount Rate. The effects of increasing the real discount rate from 2.0 to 3.5% are shown in Table 4. The main impact is to reduce substantially the present value of retirement income. CPP benefits in aggregate fall to about 65% of contributions (the contribution rate has not been changed) while aggregate OAS and GIS benefits as a share of total federal taxes fall from 28.3 to 19.1%. Nevertheless, the lifetime redistributive impact is almost unaffected. Of course, this is expected because the underlying lifetime profiles of the variables remain unchanged; all that is changed is the way these lifetime profiles are valued.(7) Another implication is that even with wage indexing of benefits, a higher discount rate significantly increases the inadequacy of expected retirement incomes.

B. Returns to Personal Saving

1. Details of the Portfolio Strategies. In this section, the impact of alternative saving strategies is examined. This analysis is admittedly mechanistic. No account is taken of behavioural responses to various tax incentives, nor of the possibility of different before-tax rates of return for different types of saving portfolios; a constant 3.5% yield is being assumed. The basic concern is with the income tax and transfer treatment of alternative forms of saving. In almost all cases, the same rate of saving and before-tax yield will be assumed. The husband begins saving 5% of his (before-tax) earnings at age 18 when he enters the labour force. All of the yield is immediately reinvested (or held, in the case of accrued capital gains) independently of any tax consequences. The wife does no saving on her own account.

This saving pattern continues up to retirement. At that point, saving ceases and dis-saving begins. The pattern of dis-saving is as if a two-thirds joint and survivor annuity were purchased with the husband's accumulated wealth. (Recall that the life expectancies being used for the representative families are tnose at age 18, not at age 65. As a result, savings are being run down over a shorter time period than if it were known with certainty that the husband would survive at least to age 65.) The tax treatment of investment income and saving is the same post-retirement as it is pre-retirement. It is as if each year during retirement, the family members knew their exact dates of death and consulted an annuity table to determine how much of their capital to draw upon that year in order to leave no terminal bequest or debt. With zero inflation, the $1,000 interest, dividend, taxable capital gains and pension income deductions will be ignored.

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(7) In principle, of course, taxes and the CPP contribution rate could be lower with this higher discount rate. However, the changes would be relatively small and would not affect the general conclusions.

TABLE 4

Simulation with Real Discount Rate of 3.5% Rather than 2.0%, Selected Variables by Lifetime Income Profile

(see key to Tables for description of variables and format)

PRESENT DISCOUNTED VALUES AT ANNUAL RATES ($000'S)

	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-95	95-100	*MEDIAN*	*MEAN*
EARN	2.20	4.70	6.57	8.09	9.40	10.62	11.95	13.56	16.04	19.65	32.91	10.05	10.94
S	.020	.043	.060	.074	.086	.097	.109	.124	.147	.090	.150		
CPPC	.10	.30	.46	.57	.62	.64	.66	.68	.69	.70	.70	.63	.64
S	.019	.056	.084	.105	.114	.119	.122	.125	.127	.064	.065		
PRETPTX	.00	.12	.50	.87	1.22	1.57	1.97	2.50	3.39	4.92	11.37	1.40	1.67
S	.000	.006	.025	.043	.060	.077	.097	.123	.167	.121	.280		
PRECON	2.13	4.14	5.36	6.31	7.16	7.94	8.77	9.76	11.20	13.11	19.24	7.57	8.14
S	.027	.052	.068	.080	.091	.101	.111	.124	.142	.083	.122		
PUBRETC	.22	.42	.61	.76	.85	.89	.95	1.02	1.12	1.26	1.86	.89	.93
S	.026	.050	.073	.090	.101	.106	.114	.121	.133	.075	.111		
OAS	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
S	.100	.100	.100	.100	.100	.100	.100	.100	.100	.050	.050		
C	.517	.266	.205	.174	.154	.139	.125	.113	.098	.084	.057	.145	.135
GIS	.73	.53	.39	.30	.27	.26	.26	.26	.26	.26	.26	.26	.26
S	.208	.152	.112	.085	.076	.073	.073	.073	.073	.037	.037		
C	.342	.128	.073	.047	.037	.032	.029	.026	.023	.020	.013	.034	.031
CPPB	.30	.66	.93	1.11	1.18	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
S	.030	.065	.091	.109	.115	.118	.118	.118	.118	.059	.059		
C	.143	.161	.174	.177	.165	.151	.137	.123	.107	.092	.062	.158	.148
CPPC	1.003	.743	.695	.668	.651	.637	.622	.604	.595	.588	.582	.643	.638
TETRAN	2.13	2.30	2.42	2.51	2.54	2.56	2.56	2.56	2.56	2.56	2.56	2.55	2.56
S	.086	.093	.098	.102	.103	.104	.104	.104	.104	.052	.052		
C	1.002	.555	.452	.398	.356	.322	.291	.262	.228	.195	.133	.337	.314
PUBRETC	3.264	1.865	1.344	1.129	1.022	.973	.912	.855	.778	.692	.468	.982	.940
RETCON	2.13	2.30	2.42	2.51	2.54	2.56	2.56	2.56	2.56	2.56	2.56	2.55	2.56
S	.086	.093	.098	.102	.103	.104	.104	.104	.104	.052	.052		
C	1.002	.555	.452	.398	.356	.322	.291	.262	.228	.195	.133	.337	.314
FS-R	1.323	.739	.598	.525	.466	.420	.379	.339	.295	.251	.173	.441	.410
FS-A	1.731	.653	.496	.424	.370	.330	.294	.261	.224	.188	.125	.348	.321
CONS	2.13	3.67	4.61	5.34	5.98	6.57	7.19	7.93	9.01	10.43	15.00	6.29	6.72
S	.033	.056	.071	.082	.092	.101	.110	.122	.138	.080	.115		
FPTX	.00	.04	.23	.42	.59	.77	.98	1.24	1.70	2.48	5.81	.69	.83
S	.000	.004	.022	.041	.059	.076	.097	.123	.168	.122	.287		
PPTX	.00	.05	.14	.23	.31	.40	.49	.62	.83	1.19	2.67	.36	.42
S	.000	.010	.029	.046	.062	.079	.098	.123	.167	.119	.267		
FOTX	.77	.70	.78	.80	.90	.85	.94	.95	1.08	1.15	1.65	.94	1.01
S	.084	.076	.086	.087	.098	.093	.102	.104	.118	.063	.090		

Six alternative saving scenarios have been simulated as follows:

1. Bank saving (BANK): all interest is taxable. Since the inflation rate is assumed to be zero, only the real yield is taxed.

2. House saving (HOUSE or HOUSE + RHOSP): none of the yield, in the form of imputed rental income or capital gains, is taxable. Since imputed rent must be current consumption, the example is somewhat contrived in that 100% of the yield is assumed to be saved pre-retirement. One interpretation of this situation is that in addition to the 5% saved out of earnings, there is additional saving exactly equal to the annual consumption of imputed rent. Alternatively this scenario simply represents tax exempt saving. (The assumption that 100% of the yield is saved pre-retirement is necessary to keep the six scenarios comparable.) In addition, the RHOSP (Registered Home Ownership Savings Plan) provisions will be considered whereby up to $1,000 per year of saving out of earnings for the purpose of purchasing a house is deductible from income before tax, with a lifetime limit of $10,000. Both RHOSP limits are assumed to be wage indexed, though in fact they are not indexed at all.

3. Dividends (DIVDN): all investment is in shares that pay the whole of their yield in the form of eligible Canadian dividends. As a result, the yield is grossed up for income tax purposes and is eligible for the dividend tax credit at the 1978 rate. Note that questions of corporate income tax integration are being ignored.

4. Realized capital gains (RCG): all investment is in an asset that appreciates at a uniform rate equal to the before-tax yield. Each year, all capital gains are realized and the funds immediately reinvested. One-half of these gains is taxable.

5. Accrued capital gains (ACG): all investment is in an asset that appreciates at a uniform rate equal to the before-tax yield. None of the capital gains is realized pre-retirement. After retirement, the most recently purchased assets are sold first, so that the deferral of realization of the gains is maximized. There is a tax free rollover to the wife when the husband dies.

6. RRSP: all saving out of earnings is tax deductible at the time it is made. Before retirement, the yield on the investment is accumulated tax free within the plan. The $5,500 contribution limit is wage indexed, and at a 5% saving rate is never a constraint. After retirement, both the capital and interest portions of the dis-saving are taxable. There is a tax free rollover to the wife when the husband dies.

In all cases, GIS benefits are income tested. The definition of income used to reduce GIS benefits is the same as net income as defined for income tax purposes except that OAS is excluded. RRSP dis-saving, interest, taxable (i.e. grossed-up) dividends, taxable (i.e. one-half) capital gains, as well as CPP benefits therefore reduce GIS benefits.

Given these saving scenarios, Figures 2 to 5 display successively four sets of variables as a function of lifetime earnings: the real rate of return, the relative and then absolute family size adjusted continuity of consumption, and the percentage increase in average annual real lifetime consumption. In all cases, it might be noted, the 5% saving rate out of earnings and the accumulation of all investment income results, at the point of retirement, in an amount of accumulated wealth equal to about 3.25 times average annual pre-retirement earnings. Data for 1970 given in Wolfson (1979) indicate that mean wealth just before retirement was about 2.5 times pre-retirement mean income. The corresponding ratio for median income and wealth (which is much less likely to be affected by inheritances and gifts inter-vivos, and is therefore more likely to reflect lifecycle saving only) was about 1.75. Thus, the saving rates generally assumed in the model likely overestimate actual rates.

2. Rates of Return. Figure 2 presents the real after tax and transfer rates of return for the alternative saving strategies. For the bottom half of the income spectrum, a house is apparently the most attractive investment while for the upper half of the income spectrum, RRSPs and houses dominate. Bank saving is the least attractive way to save except for the bottom two deciles, where RRSPs are even poorer. The tax treatment of dividends is somewhat better than that of accrued capital gains in the second through sixth deciles.

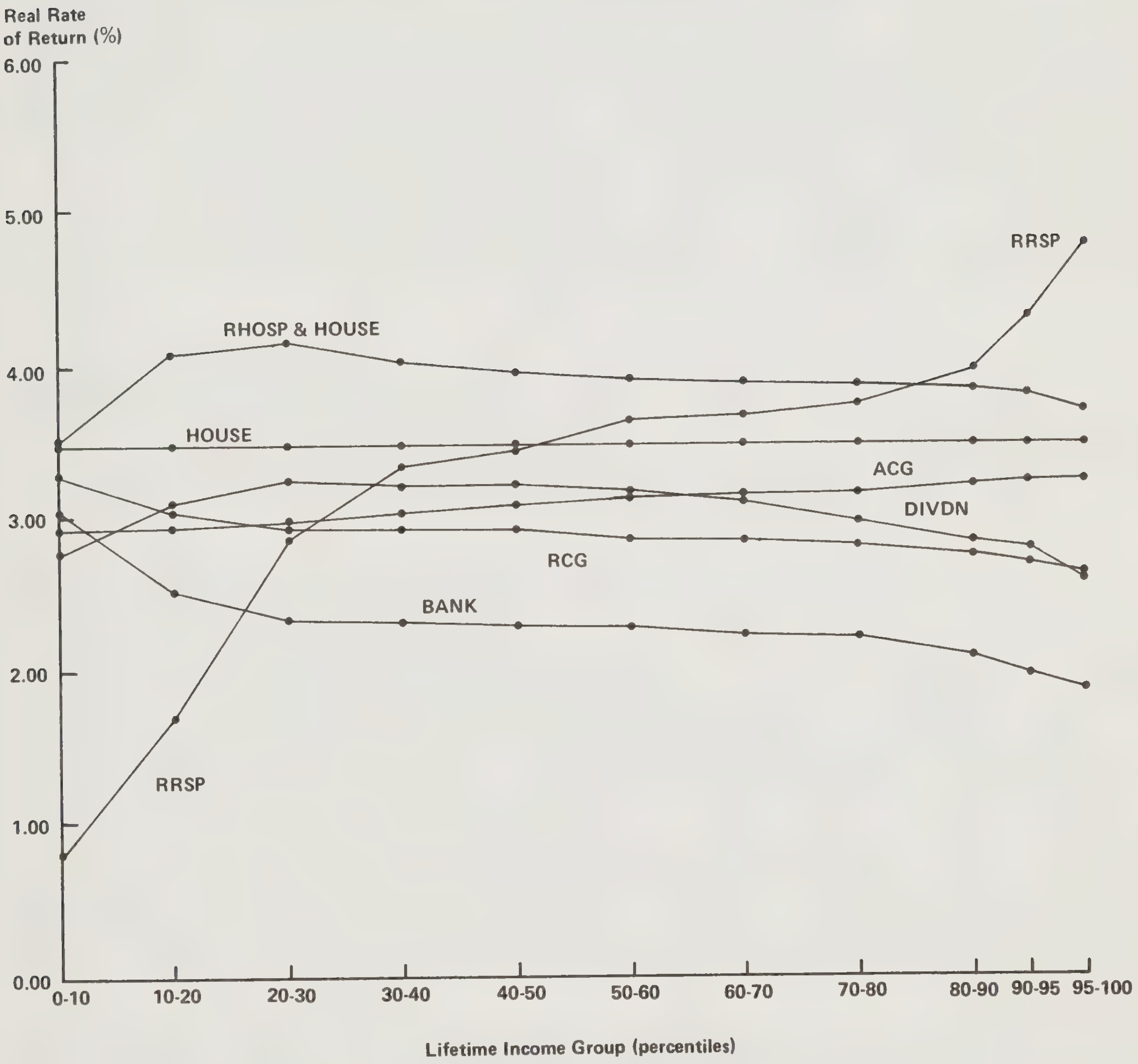
The tax-transfer treatment of saving in a house, from the rate of return perspective, is distributionally neutral except for the RHOSP provisions, which in fact appear somewhat redistributive above the first two deciles. The reason is that the RHOSP is essentially a $10,000 lifetime income tax deduction; and deductions are relatively redistributive or progressive because their value, which is proportional to the taxpayer's marginal tax rate, increases less than proportionately with income. Of course this analysis ignores the fact that the proportion of taxpayers actually making use of the RHOSP provisions increases with income. Similarly, no account is taken of the greater difficulties low-income families face in buying a house, for example, as a result of the fact that the smallest house on the market may be more than they can or wish to afford.

RRSP saving has the most pronounced distributional 'tilt'. For the top vingtile, the after-tax and transfer yield on RRSP saving is more than one full percentage point above the pre-tax yield. This results from the fact that the pre-retirement tax savings from deductibility are much larger than the taxes finally payable post-retirement, in turn a result of both the tax deferral advantages and the lower marginal rates of tax typical after retirement. Accrued capital gains also appear to be slightly regressive, and for the upper deciles the after-tax and transfer yield provides over 90% of the pre-tax real yield. Dividends are regressive for the first three deciles, mainly because the dividend tax credit is not refundable, and mildly progressive thereafter. The other two saving strategies (BANK and RCG) have a somewhat progressive tax-transfer treatment.

FIGURE 2

Real After Tax and Transfer Rates of Return for Alternative Saving Strategies

(see Section III.B.1 for saving strategy definitions)



It should be noted perhaps that the bottom deciles, even though they may be subject to tax rates of over 50% during retirement from GIS, are still able to attain net yields on saving on most portfolios that are comparable to those of higher income groups. The reason, simply, is that the GIS 'tax back' applies only during a fraction of a lifetime, and only to the yield from saving. The capital portion of dis-saving during retirement has no effect on GIS benefits, except in the case of RRSPs (and RPPs, which have not been explicitly considered). Thus, with the exception of registered saving, the GIS income testing does not appear to pose a significant financial disincentive to saving for retirement.

3. Effects on Consumption. The impact of personal saving on continuity of consumption is shown in Figures 3 and 4. (The curve labelled BANK* is discussed below.) The main observation, not surprisingly, is that saving results in an upward shift in the continuity of consumption curve. The ratio of RETCON to PRECON obviously increases since saving reduces PRECON and increases RETCON. The fact that the upward shift in the curve is close to parallel indicates that the distributional differences in the tax-transfer treatment of saving just described in terms of rates of return are small relative to the distributional tilt of the basic taxes and transfers themselves. Nevertheless, there is some reduction in redistributive impact apparent when there is saving.

Despite the range of real net rates of return shown in Figure 2, all of the saving strategies have very similar results in increasing the continuity of consumption ratios except RRSPs. RRSP saving has a smaller impact because the income tax treatment is such that PRECON falls less (the 'benefit' of tax deductibility) while RETCON increases less (the 'cost' of taxing the capital portion of dis-saving).

The continuity of consumption ratio is greater than one for the bottom seven deciles in Figure 3 if they save 5% of their earnings and all of their investment income from age 18 to age 64 (other than in a RRSP). The implication is that for these income groups, lower rates of personal saving would suffice to assure comparable levels of consumption both pre-and post-retirement. The curve labelled BANK* shows the continuity of consumption situation under the alternative assumptions that 5% of investment income is saved rather than 100%, and that saving starts at age 30 rather than at age 18, with real yields being fully taxable. (It is still being assumed that 5% of earnings are saved.) These saving assumptions result in accumulated wealth at retirement equal to about 1.5 times average annual pre-retirement earnings, a more realistic figure. In this case, saving is not sufficient to provide continuity of consumption for the top six deciles.

In Figure 4, where the absolute family size adjustment has been displayed, fewer families achieve continuity of consumption. The reason for the differences between the two kinds of adjustments may be illustrated by the fact that under the relative adjustment, PRECON is divided by 2.33 when both children are at home, rather than reduced by $2,400.

FIGURE 3

Relative Family Size Adjusted
Continuity of Consumption for
Alternative Saving Strategies

(see Section III.B.1 for saving strategy definitions)

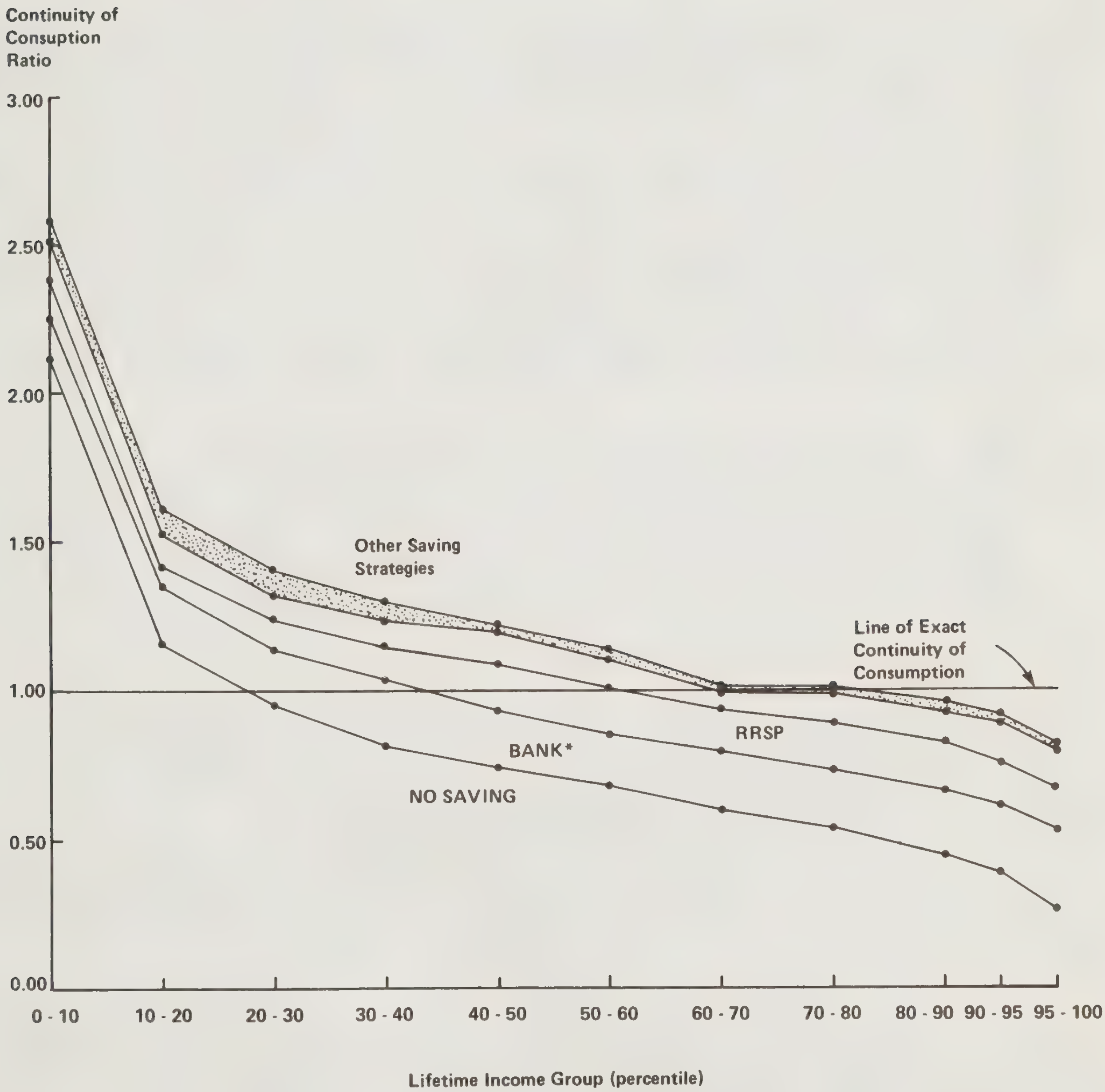
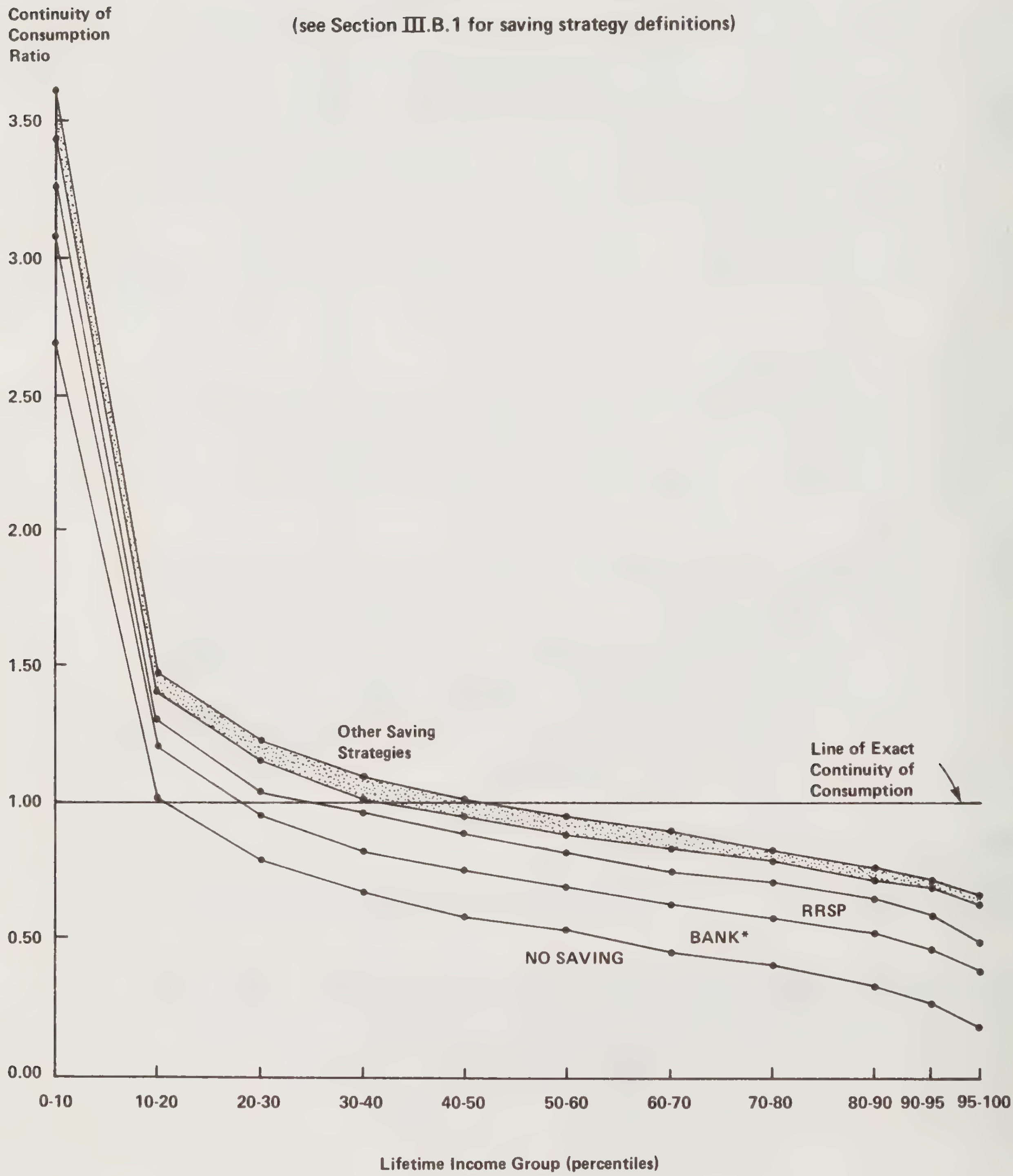


FIGURE 4

Absolute Family Size Adjusted
Continuity of Consumption for
Alternative Saving Strategies

(see Section III.B.1 for saving strategy definitions)



Clearly, the latter adjustment has a smaller impact at higher levels of consumption. The differences between the two figures suggest that an assessment of the adequacy of the retirement income system will be fairly sensitive to the method of family size adjustment. As already noted, there may be some preference for the absolute family size adjustment.

The fact that RRSP saving generates lower continuity of consumption ratios than the other saving strategies does not necessarily imply that RRSP saving is a poor choice. On the contrary, Figure 2 showed that for higher-income families, RRSP saving offered the highest net rate of return. As already noted, RRSP saving has the dual effect of deferring consumption and lowering pre-retirement income taxes.

Figure 5 shows a similar result to Figure 2 in that RRSP saving results in a significant increase in lifetime consumption over the alternative of no saving, particularly for the top two vingtiles. In general, saving should be expected to increase lifetime consumption since the discount rate is lower than the yield on deferred consumption. The general picture that emerges from Figure 5 regarding the best forms of saving is almost identical to that of Figure 2. House saving is most attractive except at the top of the income spectrum where RRSP saving dominates. For investments in shares, lower-middle income investors should prefer eligible Canadian dividends while high-income investors should accrue capital gains. Bank saving is the least attractive for everyone, and RRSPs appear particularly unattractive for low-income families.

4. Inflation. The analysis so far has generally assumed zero inflation. However, a major concern at the present time is with the impact of inflation on saving. One main aspect of this concern is the income tax and transfer treatment of nominal as well as real yields on saving. Other important aspects include the effects of inflation on personal saving rates and on before-tax yields. Only the first of these aspects will be considered here.

It is a straightforward matter to simulate the after-tax and transfer yields for alternative saving strategies with a given rate of price inflation. Results, with and without a 5% rate of inflation (but the same real yield, real growth rate of average wages, and real discount rate), are shown in Figures 6 and 7. BANK and RRSP saving are considered in Figure 6. The picture that emerges from this figure is that real net yields on RRSP saving are almost completely unaffected by inflation, as compared to those for BANK saving which are significantly reduced.

These results should not be surprising. To the extent that inflation is reflected in higher nominal yields, nominal interest payments become a blend of real interest payments and repayments of capital. Currently, the income tax base includes the whole of these nominal yields. Despite the general reliance on the 'relative world' indexing scenario in the model, the income base of the income tax system (as opposed to the rate structure) has not been assumed to be indexed explicitly (it has been done implicitly by assuming zero price inflation).

FIGURE 5

Increase in Lifetime Consumption for Alternative Saving Strategies

(see Section III.B.1 for saving strategy definitions)

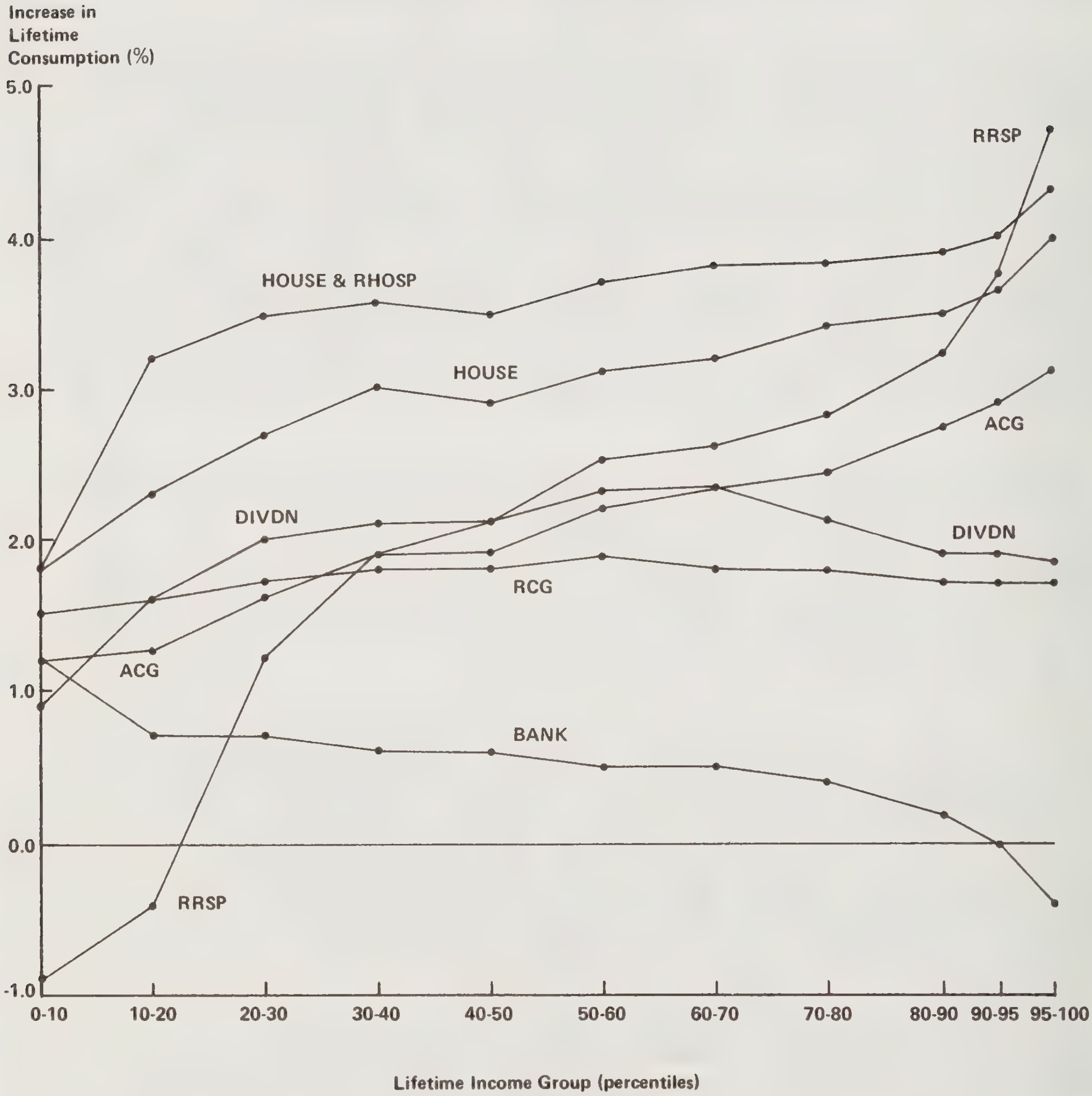


FIGURE 6

Effect of Inflation and $1000 Interest
Deduction on Real After Tax and Transfer
Rates of Return for Bank and RRSP Saving

Key : a — no inflation, no deduction
b — 5% inflation, no deduction
c — 5% inflation, unindexed $1000 deduction
d — 5% inflation, price indexed $1000 deduction
e — 5% inflation, wage indexed $1000 deduction

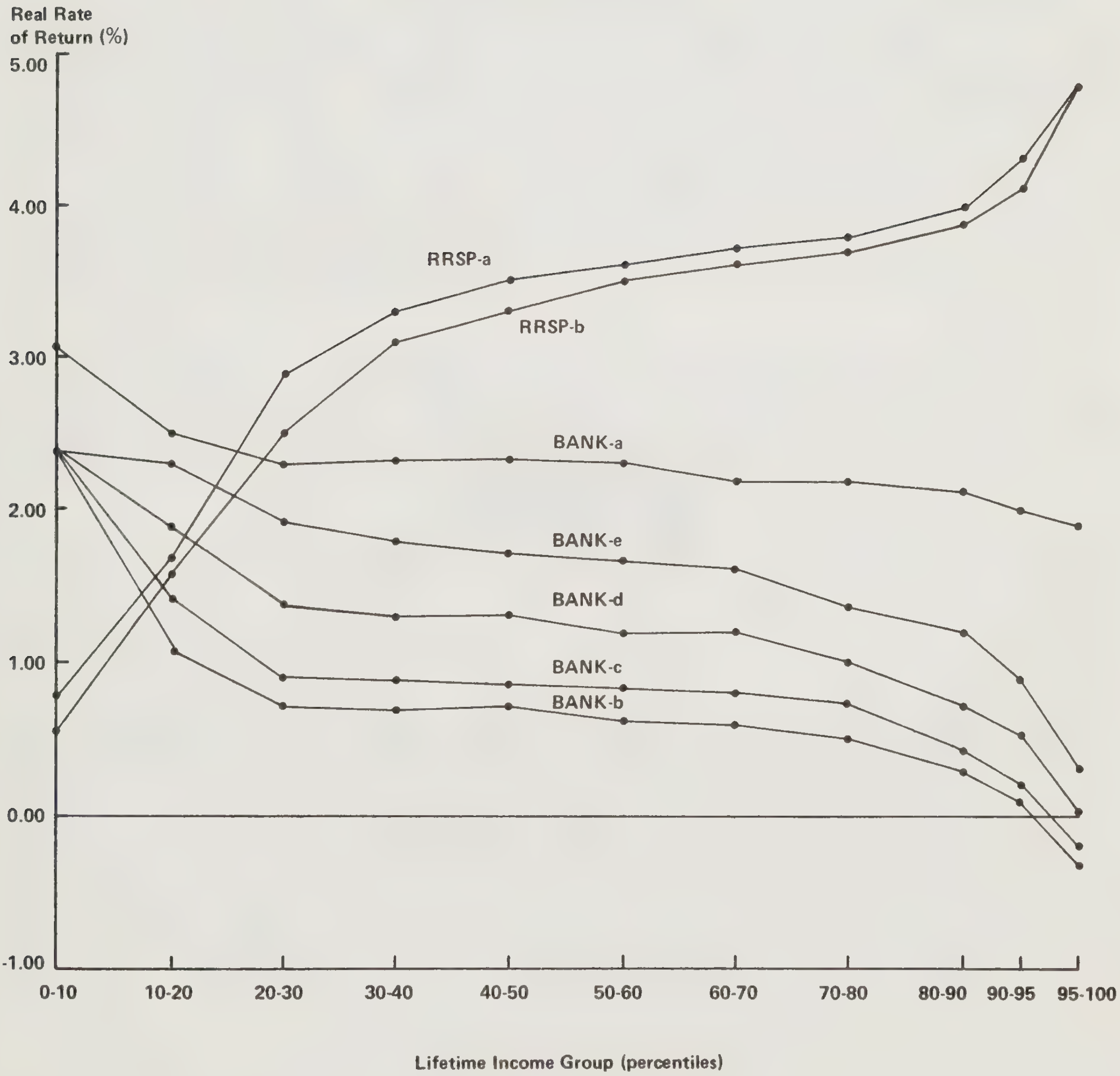
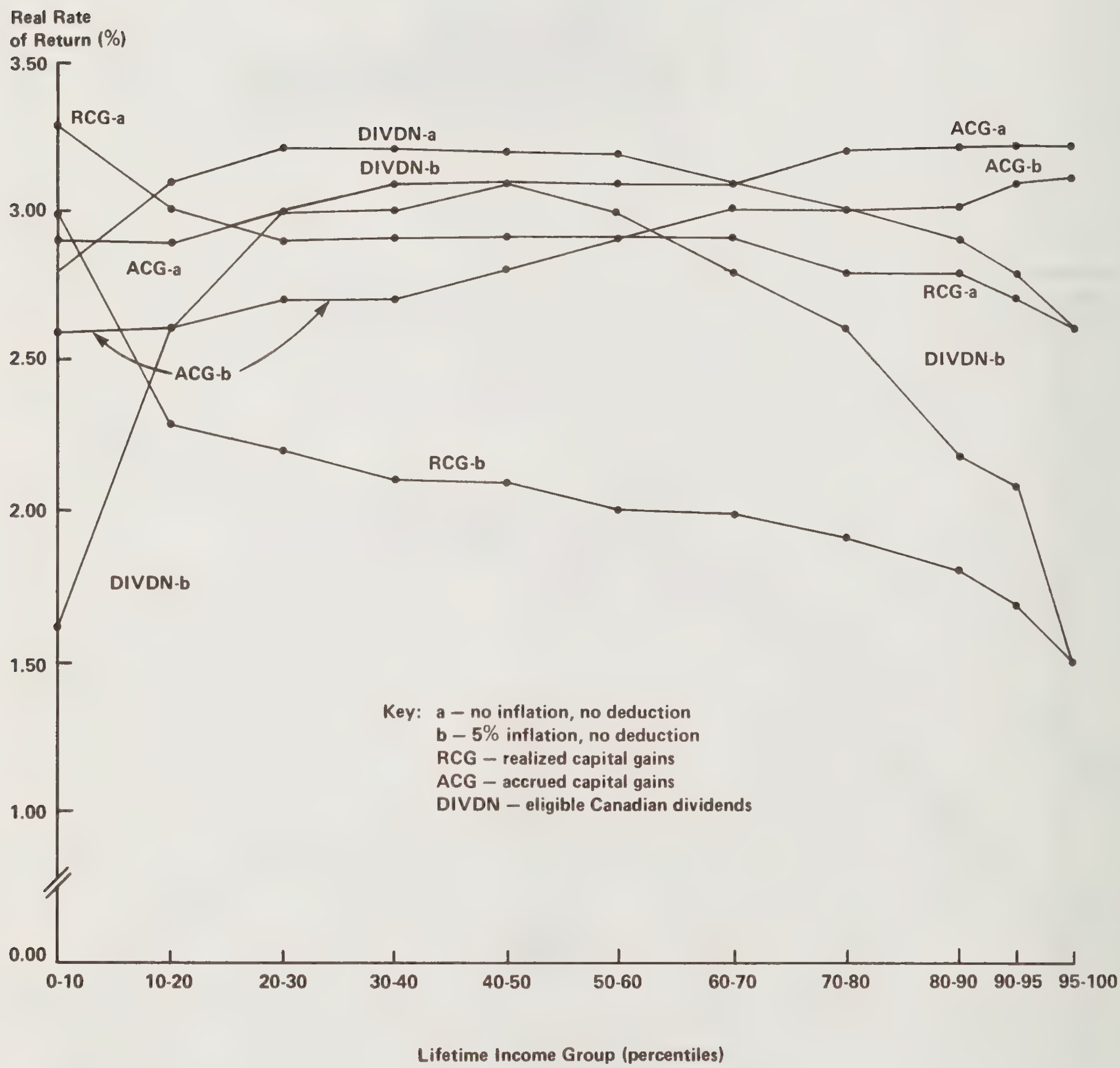


FIGURE 7

Effect of Inflation on Real After Tax
and Transfer Rates of Return for
Three Alternative Saving Strategies



Thus, at a 5% assumed rate of price inflation, repayments of capital are included in taxable income in the case of BANK saving. In turn, income taxes on this form of saving are increased and real net yields are reduced. With RRSPs, however, the capital portion of dis-saving after retirement is taxable in any case, while before retirement the yield is not taxable. As a result, inflation related changes in the blend of real yields and capital repayments should have no effect at all on the real net return to RRSP saving. In fact, there are only two reasons for any differences at all between the two sets of simulated rates of return for RRSP saving: first, inflation has some effect on the level of CPP benefits, hence on post-retirement income tax brackets and marginal tax rates; and second, the dis-saving is assumed to be analogous to an annuity (as described above) where the payments are constant in nominal terms. As a result, real dis-saving is shifted earlier in the post-retirement period with inflation.

One other factor examined in Figure 6 is the $1,000 interest deduction. Three alternatives have been considered in the case of BANK saving: one where the $1,000 amount is not indexed (the current situation), one where it is price indexed, and one where it is assumed to be wage indexed. As one would expect, the greater the extent to which the $1,000 deduction is indexed, the higher the real net yields. Still, the $1,000 deduction, even if it is wage indexed, does not raise real net yields to the levels that would be obtained if the income tax base were itself indexed. In this latter case, inflation would have no effect at all on real net yields. However, the $1,000 deduction is more progressive distributionally than full price indexation of the income base. This is indicated in Figure 6 by the fact that the curve BANK-e, for example, has a slightly more pronounced downward slope than the curve BANK-a, or BANK-b for that matter.

In Figure 7, the impact of 5% inflation on DIVDN, RCG, and ACG saving is displayed. No $1,000 deduction is assumed. (The tax-transfer treatment of HOUSE saving ignoring RHOSPs, since the yield is tax exempt, is unaffected by inflation.) The main observation is that the real net yields on accrued capital gains (ACG) throughout the income spectrum and on eligible Canadian dividends (DIVDN) in the lower and middle income ranges are not very strongly affected by inflation. However, inflation does have a significant impact on the real net yields from saving in the form of realized capital gains (RCG) in all but the bottom decile, and from eligible Canadian dividends at the extremes of the income spectrum.

As a result of these observations, it appears that the best forms of saving, from the point of view of maximizing the real after-tax and transfer rates of return, are in a house for the lower- and middle-income ranges, and in RRSPs for the upper-income ranges. These forms of saving are virtually unaffected by inflation, at least regarding their treatment by the tax system. For upper income families who are constrained by the RRSP contribution limits, the next best form of saving is accrued capital gains, which are also relatively unaffected by inflation. For families in the lowest deciles, HOUSE saving may not be a feasible alternative. In that case, the alternatives are not very attractive.

BANK and RRSP saving, which are probably the most accessible, are also the least attractive in terms of real net yields. However, even without any saving these families can expect post-retirement consumption that is higher than their pre-retirement levels of consumption (recall Figures 3 and 4). Thus, these families would probably not want to be saving for their retirement in the first place.

5. CPP Deferral Treatment and the Age Exemption. Two further aspects of the retirement income system have also been examined, namely the personal income tax treatment of CPP contributions and benefits, essentially on the same tax deferral basis as RRSPs, and the age exemption. Table 5 shows the hypothetical changes in pre-retirement total income tax, post-retirement total income tax (both where relevant), and lifetime consumption that would result from eliminating both tax deductibility of CPP contributions and tax on CPP benefits, or the age exemption. Two saving assumptions have been examined: no saving and RRSP saving. RRSP saving results in the highest levels of post-retirement income taxes, hence the greatest potential impact for the age exemption. In the absence of any saving, post-retirement personal income taxes are virtually zero for everyone.

Eliminating the deferral treatment of CPP in the income tax system would raise pre-retirement income taxes for everyone except those in the bottom decile. This average annual tax increase would, for example, be about \$170 in the third decile and about \$310 in the eighth decile. It would be concentrated in the lower and middle lifetime income ranges, judging by the changes in the relative shares of tax payable. After retirement, tax decreases would be concentrated among the middle-income groups in the RRSP saving case. The provision is 'absolutely regressive' in that lifetime consumption would generally drop more in dollar terms as one moved up the income spectrum, if the deferral provision were abandoned. The provision is also 'relatively regressive' for the bottom third or half of the income spectrum; having the provision for deductibility of CPP contributions increases lifetime consumption relatively more for the third or the fifth decile (depending on saving) than for those in lower deciles. However, the opposite is the case for the upper half of the income spectrum. Thus, CPP deferral treatment is relatively progressive for the upper half of the income spectrum. To summarize, deferral treatment of the CPP in the personal income tax generally benefits lower and middle income groups in relative terms, at the expense of both lower and higher income groups.

A corresponding analysis of the age exemption from a lifetime perspective shows that it is absolutely regressive, in that the dollar value of its benefits generally increases with income. However, when these benefits are examined relative to consumption the pattern changes somewhat. The age exemption is relatively regressive up to the fourth decile and relatively progressive above. Thus, the relative benefits of the age exemption are also concentrated in the lower and middle income groups.

TABLE 5

Lifetime Impact of Eliminating the Deferral Treatment of the CPP or the Age Exemption from the Personal Income Tax System

	LIFETIME INCOME GROUP (percentiles)												
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-95	95-100	Median	Mean
1. CPP Deferral Treatment, No Saving													
a. Change in PRETPTX ($000s)	0.0	.09	.17	.23	.25	.28	.30	.32	.38	.41	.48	.27	.28
b. Change in Share of PRETPTX (%)	0.0	0.2	0.4	0.4	0.3	0.3	0.2	0.1	-0.1	-0.3	-1.4	-	-
c. Change in CONS ($000s)	0.0	-.06	-.12	-.16	-.20	-.21	-.22	-.24	-.27	-.30	-.36	-.21	-.21
d. Change in CONS÷CONS (%)	0.0	-1.1	-1.7	-2.0	-2.3	-2.2	-2.1	-2.1	-2.1	-2.0	-1.6	-2.3	-2.1
2. CPP Deferral Treatment, RRSP Saving													
a. Change in PRETPTX ($000s)	0.0	.08	.17	.23	.25	.28	.29	.31	.36	.40	.47	.26	.28
b. Change in Share of PRETPTX (%)	0.0	0.3	0.4	0.5	0.3	0.3	0.2	0.1	-0.1	-0.3	-1.7	-	-
c. Change in RETTPTX ($000s)	0.0	0.0	-.05	-.16	-.29	-.40	-.49	-.59	-.67	-.71	-.80	-.35	-.42
d. Change in Share of RETTPTX (%)	0.0	0.0	-1.0	-3.5	-6.1	-7.8	-9.0	-9.1	-4.1	5.2	35.4	-	-
e. Change in CONS ($000s)	0.0	-.06	-.11	-.12	-.11	-.11	-.09	-.09	-.09	-.12	-.15	-.11	-.10
f. Change in CONS÷CONS (%)	0.0	-1.1	-1.6	-1.5	-1.2	-1.1	-0.8	-0.8	-0.7	-0.8	-0.6	-1.2	-1.0
3. No Age Exemption, RRSP Saving													
a. Change in RETTPTX ($000s)	.01	.15	.37	.49	.51	.51	.53	.53	.55	.57	.63	.52	.52
b. Change in Share of RETTPTX (%)	0.1	1.7	3.7	3.8	2.7	1.7	0.7	-0.6	-2.5	-2.7	-8.7	-	-
c. Change in CONS ($000s)	-.01	-.04	-.09	-.12	-.13	-.14	-.13	-.14	-.13	-.14	-.16	-.13	-.13
d. Change in CONS÷CONS (%)	-0.3	-0.7	-1.3	-1.5	-1.4	-1.4	-1.2	-1.2	-1.0	-0.9	-0.7	-1.4	-1.3

Abbreviations:

CPP - Canada Pension Plan
RRSP - Registered Retirement Savings Plan
CONS - lifetime consumption
PRETPTX - Pre-retirement
RETTPTX - Post-retirement
$\left.\begin{matrix}\text{Pre-retirement}\\ \text{Post-retirement}\end{matrix}\right\}$ total personal income taxes
$\left.\begin{matrix}\text{lifetime consumption}\\ \text{total personal income taxes}\end{matrix}\right\}$ (annual average present discounted values)

IV. SUMMARY AND CONCLUSIONS

The main objective of this paper has been to provide a quantitative analysis of the expected lifetime impact of the retirement income system in Canada. The analysis has focussed on three main questions: how redistributive is the system; will it generate adequate levels of consumption during retirement; and what are the incentives to personal saving for retirement. A lifetime perspective was adopted for the analysis in order that taxes, contributions, and saving during the working years could be considered in conjunction with taxes, benefits, and dis-saving during retirement.

In order to perform this analysis, a relatively simple computer simulation model was constructed. This model has incorporated the main elements of the retirement income system (OAS, GIS, CPP) and the personal income tax system. The focus has been on the age cohort that was age 18 in 1977, and what they can expect from Canada's retirement income system over their lifetimes. Since this cohort will not be retiring until 2024 (assuming 65 remains the usual age of retirement), it is clear that the model itself must be substantially hypothetical and stylized. Essentially, it has been assumed that over the next three-quarters of a century, economic growth will be at constant rates and that the current relative shares of taxes and transfers in GNP will remain fixed. This growth scenario, in which these relative shares do not change, is equivalent to the assumption that OAS and GIS benefit levels and income tax rate brackets and exemptions are indexed to the growth in average wages and salaries.

The first basic conclusion is that under the above assumptions, the retirement income system can be expected to be substantially redistributive. The shares of lifetime consumption (earnings plus transfers plus dis-saving less taxes, contributions, and saving) of the lowest lifetime income groups are significantly greater than their shares of earnings, and vice versa for the highest-income groups. GIS has the greatest redistributive impact in lifetime terms while CPP has the least. Nevertheless, CPP benefits and contributions are still somewhat redistributive, in the sense that their impact is to lower lifetime income inequality. These conclusions also hold when taxes and transfers are price indexed, as at present, rather than wage indexed.

The main indicator that has been used here for the adequacy of post-retirement consumption did not involve comparisons with a poverty line index. Rather, the focus was on the continuity of consumption: the ratio of average post-retirement consumption levels to average pre-retirement consumption levels. According to this indicator, few individuals can expect to achieve continuity of consumption by relying only on the public programs. For the poorest 10 or 20% of the population, average post-retirement consumption levels could well exceed average pre-retirement consumption levels. For the upper 50 or 70% of the population, however, average post-retirement consumption levels could well be 25-50% below corresponding pre-retirement levels if no other provisions for retirement are made. If OAS and GIS benefits remain price indexed rather than maintaining their current position relative to average

wages and salaries, almost all of the age cohort that was 18 in 1977 could well expect average post-retirement consumption levels of less than half their average pre-retirement consumption.

Of course, if should be noted that if the retirement income system were perfectly successful in assuring exact continuity of consumption, it would not follow that the system would be redistributive. The continuity of consumption indicator focuses on the extent to which individuals and families are able to allocate their own incomes over their lifetimes, and not on the average levels of their lifetime incomes. Redistribution, on the other hand, focuses on the before- and after-tax and transfer dispersion in lifetime incomes. Measurements of the redistribution of lifetime incomes are not necessarily affected by reallocations of income within a lifetime.

It is open to individuals and families to supplement the public sector components of the retirement income system with private savings. Indeed, the RRSP provisions of the personal income tax system are an explicit incentive designed to encourage such behaviour. One question is how private savings for retirement are treated by the whole of the retirement income system, taxes and tranfers combined, and how various forms of saving compare. To this end, a number of hypothetical saving strategies have been simulated. These saving strategies are quite stylized and have been designed to illustrate a number of polar cases.

A number of broad conclusions have emerged from the analysis of these hypothetical saving alternatives. In terms of the after-tax and transfer rate of return, the most attractive form of saving for the bottom half of the population was in an owner occupied house, while for the top 10 or 20% the RRSP was most attractive. In fact, the top income groups were able to achieve after-tax rates of return that exceeded the before-tax rates using RRSPs. However, RRSPs were the least attractive form of saving for the poorest fifth of the population. Saving in the form of bank deposits (or other interest bearing vehicles) was the least attractive form for the rest of the population. Aside from the case of RRSP saving (and registered saving more generally), the income testing of GIS benefits did not appear to constitute a significant financial disincentive to saving from the lifetime perspective. These conclusions applied whether or not the effect of inflation on the tax and transfer treatment of savings and investment income was taken into account. In fact from the tax treatment point of view, the real after-tax yield on savings in an owner occupied house or RRSP was virtually unaffected by inflation.

From the perspective of redistributive impact, the tax-transfer treatment of RRSPs had the most pronounced redistributive pattern in favour of the upper-income groups, while bank deposits and their equivalents had an opposite redistributive pattern. In between were eligible Canadian dividends, realized and accrued capital gains, and owner occupied houses. The RHOSP provisions, it might be noted, were progressive for all but the lowest-income groups from the rate of return perspective. However, this result ignores the fact that higher-income families are more likely to make use of the provisions.

Despite the range in tax-transfer treatments of different forms of saving, the broad redistributive impact of the taxes and transfers themselves was unaffected. Even though those in the top income groups did very well with RRSPs, for example, their simulated lifetime taxes and contributions were still significantly greater than their retirement benefits.

Saving did, of course, improve the continuity of consumption indicator. Nevertheless, a saving rate of 5% of pre-tax income still left a significant gap for the top half of the population.

As a final consideration, the tax-transfer treatment of the CPP on a deferral basis and the age exemption were examined. At present, CPP contributions are tax deductible while CPP benefits are taxable. Compared to the alternative of allowing no deduction for contributions and not taxing benefits, this tax treatment involves a loss in tax revenue from a lifetime perspective. These revenue costs are concentrated among middle lifetime income groups. Thus, this provision is not unambiguously regressive or progressive. Rather, it is generally regressive for the bottom half of the population, and generally progressive for the top half. The benefits of the age exemption in lifetime terms appear similarly distributed.

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APPENDIX 6

THE MAINTENANCE OF PRE-RETIREMENT LIVING STANDARDS IN RETIREMENT

Alan Puttee*

A. Introduction

The purpose of this appendix is to amplify the discussion in Chapter IV regarding the maintenance of pre-retirement living standards in retirement, wherein it is concluded that "... using a discount rate equal to the rate of per capita economic growth, living standards of the elderly are said to be maintained when income less taxes in the first year of retirement is equal to the average level of pre-retirement consumption (.....)."(1) This appendix will:

- show how changes in this definition alter the extent to which a given pension system maintains living standards;

- compare the extent to which a given pension system maintains the living standards of one-earner couples, two-earner couples and those who are single throughout their adult lives; and

- show the effect of homeownership on the extent to which living standards are maintained.

The model that was used in deriving Figures IV-2 to IV-4 in the main text and the figures to follow is, except for certain parameter values, the same as that used in Appendix 5. The main difference between the two is that in the Appendix 5 version of the model, life expectancies for the representative families are those at age 18 whereas in the model here, life expectancies are those at age 65. This difference stems from the fact that in Appendix 5, the focus is on how a particular age cohort as a whole will fare under various pension systems, saving strategies etc. Here the concern is directed to the comparison between the pre- and post-retirement living standards of couples who will reach age 65. Another difference is that in Appendix 5, full cost Canada and Quebec Pension Plan (C/QPP) contributions are subtracted from pre-retirement earnings whereas here, half of full-cost contributions are subtracted to conform with the employee-employer splitting of contributions. There are other minor differences between the two. (Also note that in Appendix 5 the term 'continuity of consumption' has been used in the same way that 'maintenance of living standards' is used here.)

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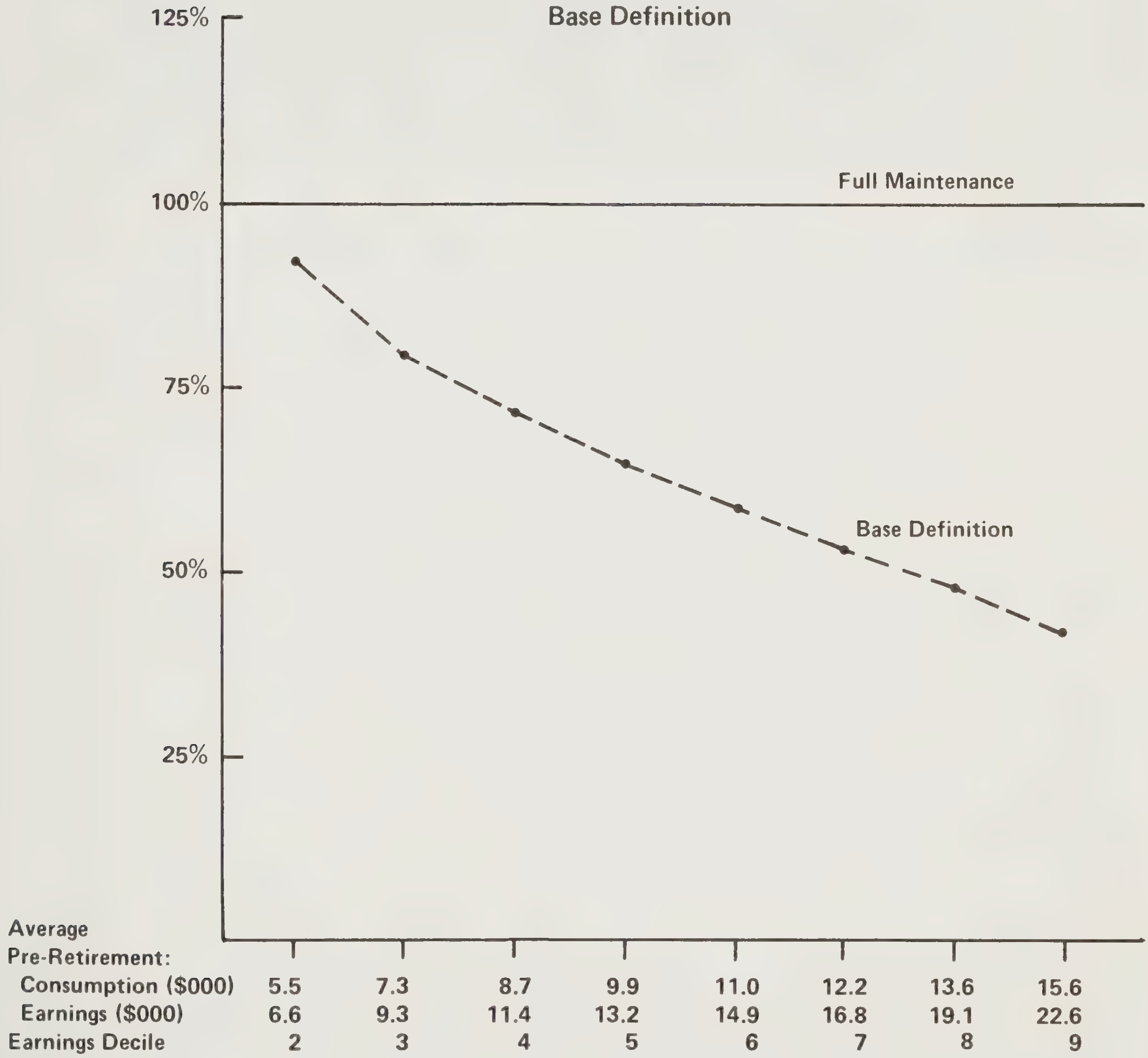
* Task Force on Retirement Income Policy. Department of Finance.
(1) The Retirement Income System in Canada: Problems and Alternative Policies for Reform. p. 108. Note that income may include annuity income which in turn includes an element of dissaving.

A particular pension system must be chosen to illustrate how the 'extent to which living standards are maintained' is affected by definitional differences (in discount rates, and in the period of retirement chosen for comparative purposes) and by differences in marital and labour force status. The pension system chosen for these illustrative purposes is one that contains an Old Age Security (OAS) pension, where benefits increase at the same rate as average wages and salaries (AWS), and a C/QPP pension that replaces 25% of average (adjusted) pre-retirement earnings lying at or below AWS. (For these illustrative purposes, the Guaranteed Income Supplement (GIS) is not included.) Figure 1 shows the extent to which such a pension system maintains pre-retirement living standards of those in the middle eight deciles.

Figure 1 shows the case of one-earner couples who make no provision for retirement beyond that implied in the OAS and C/QPP programs. The discount rate is set equal to the growth of real AWS (2% per annum) and living standards in first year of retirement are taken as indicative of post-retirement living standards. Since these elements underlie the figures in the text, Figure 1 is referred to as the 'Base Definition'.

FIGURE 1
Extent to Which Pre-Retirement Living Standards
are Maintained After Retirement by
the OAS and the C/QPP

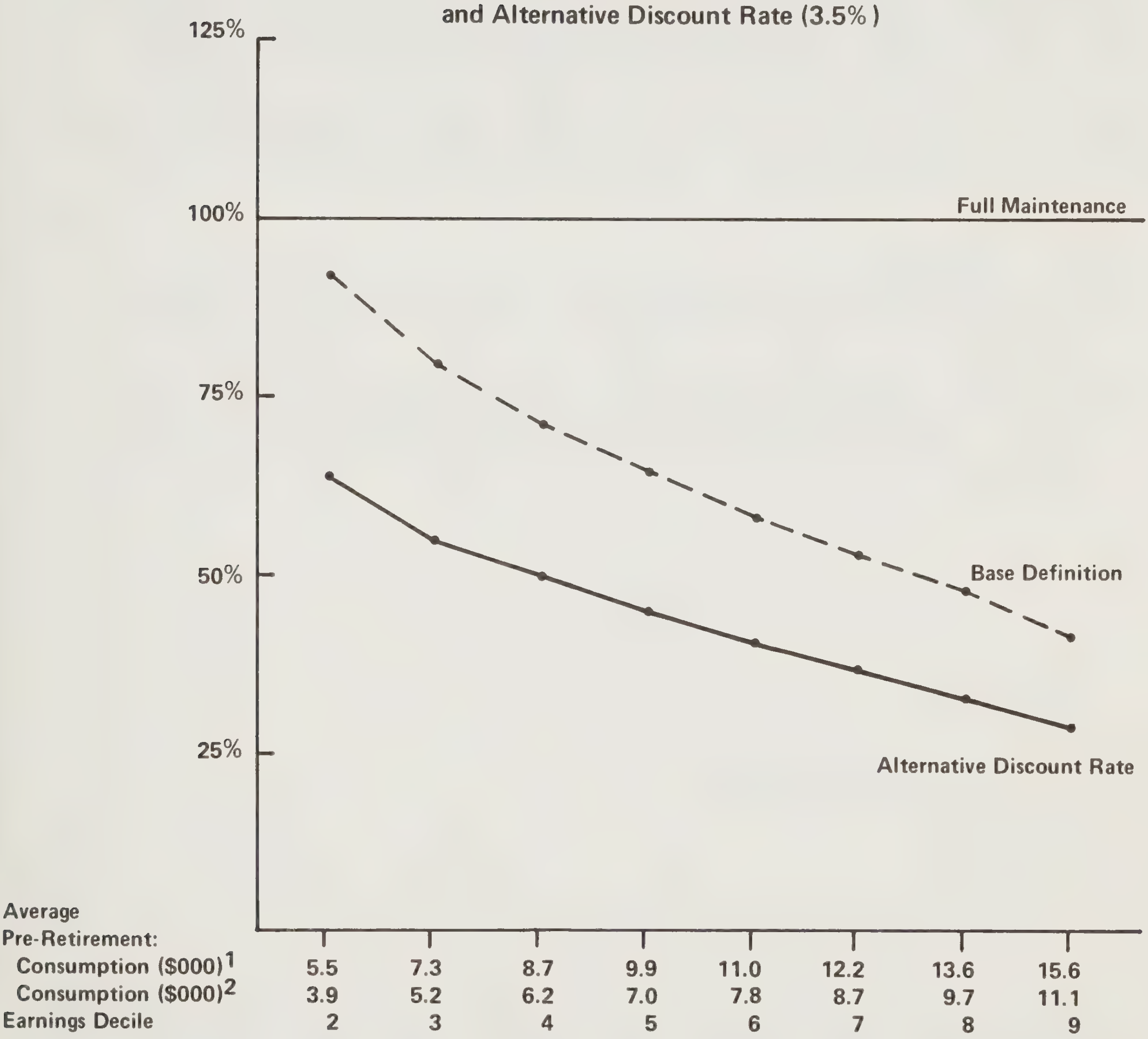


B. Definitional Differences: The Discount Rate and the Post-Retirement Period

1. The Discount Rate. The Base Definition incorporates a discount rate which equals the assumed rate of growth of AWS (2%). As noted in Chapter IV and in Appendix 5, some observers might prefer to use a discount rate related to a market rate of return. Figure 2 shows the effect of the use of a 3.5% discount rate on the extent to which the pension system described above maintains pre-retirement living standards. The higher discount rate has the effect of placing a lower value on future consumption; for the hypothetical 18-year-old viewing his lifetime stream of consumption, this means a given pension system (which supports consumption in the distant future) leaves him less well off compared to his well-being in the pre-retirement period the higher the discount rate used to make comparisons. (Note that Figure 2 has two sets of amounts of average pre-retirement consumption on the x axis; this is necessary since pre-retirement consumption is valued differently according to which discount rate is used.) Thus, the use of a higher discount rate reduces the extent to which a given pension system maintains pre-retirement living standards.

FIGURE 2
Extent to Which Pre-Retirement Living Standards are Maintained After Retirement by the OAS and the C/QPP

Base Definition and Alternative Discount Rate (3.5%)



[1]Discount rate = 2.0% (Base definition)
[2]Discount rate = 3.5%

2. <u>The Post-Retirement Period</u>. In the Base Definition, consumption in the first year when each spouse is at least age 65 is taken as indicative of post-retirement consumption; the percentage this is of average pre-retirement consumption is the measure of the extent to which living standards are maintained. An alternative would be to take average consumption throughout the post-retirement period as indicative of post-retirement consumption (as is done in Appendix 5). Figure 3 shows that the effect of this alternative definition is to reduce the extent to which a given pension system maintains living standards. One reason for this is that C/QPP benefits do not increase in real terms once in pay.(2) Streams of consumption are discounted using a rate of 2%; this means that if consumption in retirement increases at less than 2% per year, the well-being of the elderly will decline through the retirement period. This decline is reflected in measures of post-retirement well-being that average the annual retirement consumption levels; it is not reflected in the Base Definition which utilizes consumption in the first year of retirement as indicative of post-retirement consumption. A second reason for the drop in the line in Figure 3 is that for part of the post-retirement period, there is only one surviving spouse whose pension income equals between 50% and 60% of the pension income formerly paid to the intact couple.(3)

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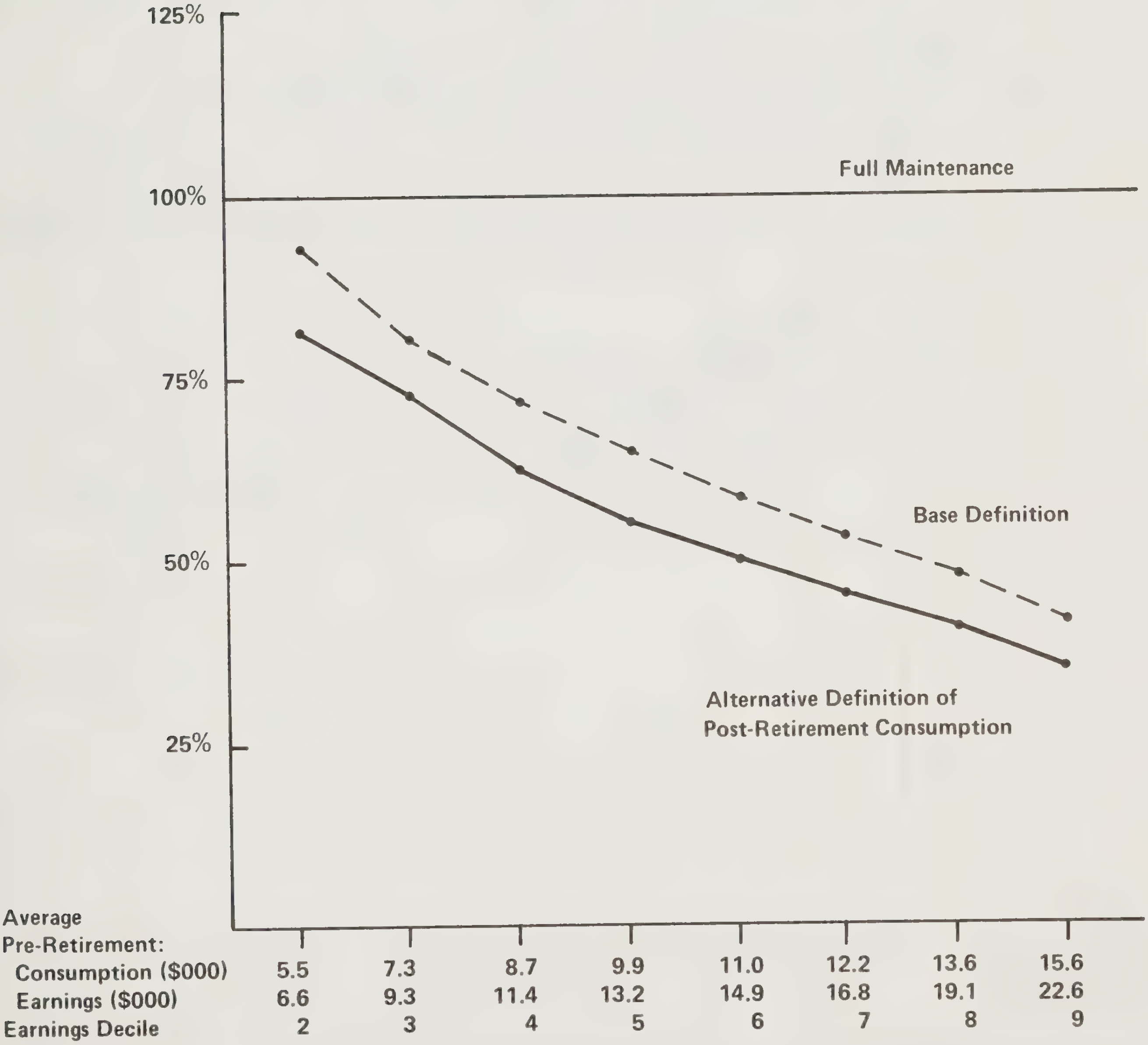
(2)OAS benefits on the other hand are assumed to increase at the same rate as AWS (i.e. 2%). Note that in Appendix 5, C/QPP benefits are assumed to increase in line with AWS.

(3)Under the alternative definition, when both spouses are present, post-retirement consumption levels are divided by 1.67 in order to provide consumption on a "per adult equivalent basis" as described in Appendix 5.

FIGURE 3
Extent to Which Pre-Retirement Living Standards are Maintained After Retirement by the OAS and the C/QPP

Base Definition and Alternative Definition of Post-Retirement Consumption

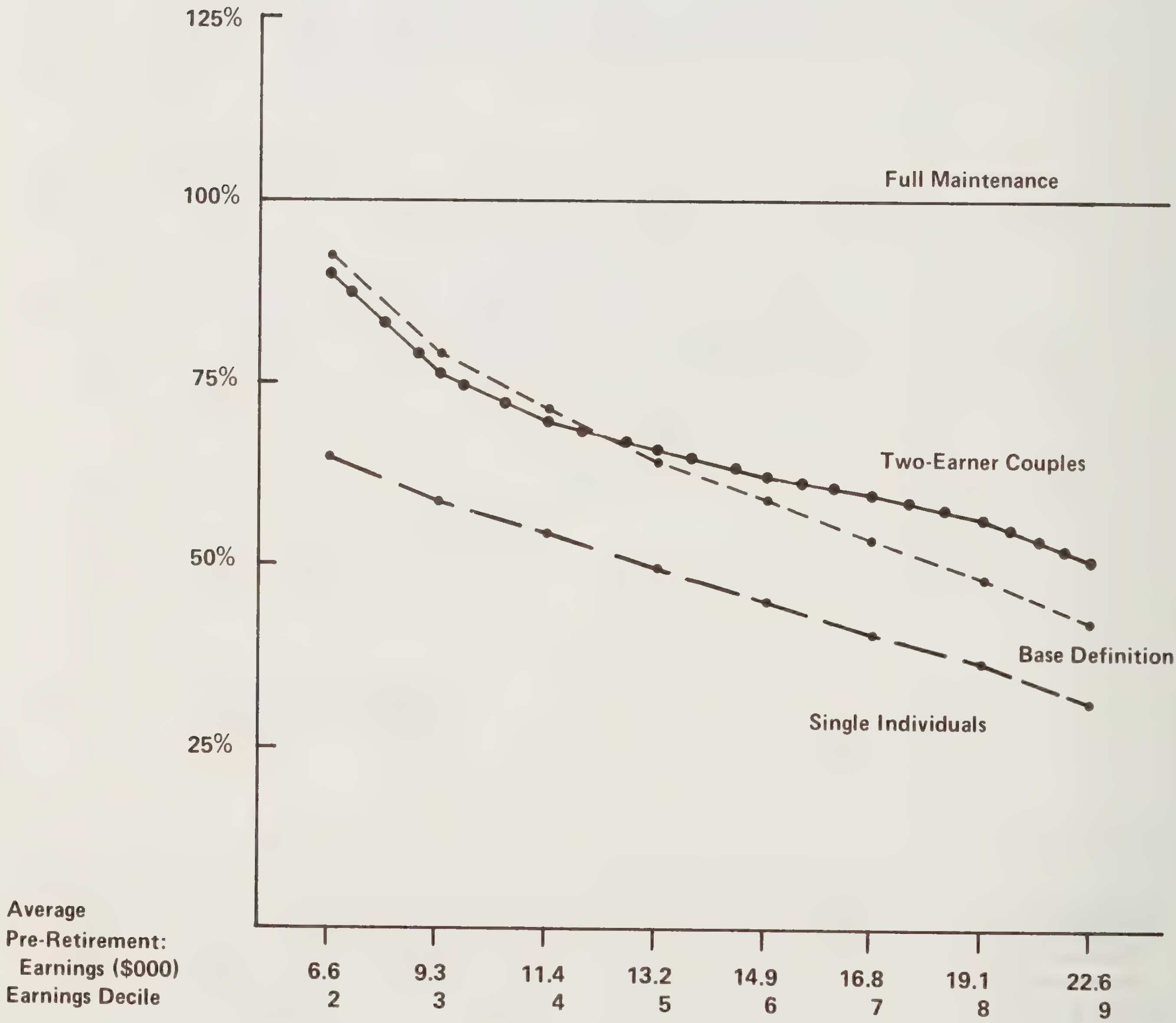


C. Labour Force and Marital Status Differences

The Base Definition utilizes the case of one-earner couples. Figure 4 shows the extent to which the OAS and C/QPP will maintain the living standards of two-earner couples and of those who are single throughout their lives.

FIGURE 4
Extent to Which Pre-Retirement Living Standards Are Maintained After Retirement by the OAS and the C/QPP

Base Definition and Two-Earner Couples(1) and Single Individuals



(1)One spouse earns two-thirds of the couple's total earnings; the other earns one-third.

Figure 4 shows that the for two-earner couples in the lower deciles the pension system maintains a smaller percentage of pre-retirement living standards than in the one-earner couple case. Retirement consumption is the same for each; but the pre-retirement consumption of these two-earner couples is higher than that of one-earner couples with the same earnings since income taxes and C/QPP contributions are lower than those paid by the one-earner couples.(4) In the higher deciles, the pension system maintains a higher fraction of pre-retirement living standards of two-earner couples than it does in the case of one-earner couples. The reason for this is the Year's Maximum Pensionable Earnings (YMPE) in the C/QPP. If, for example, the YMPE equals $15,000 and a one-earner couple has earnings of $20,000, $5,000 of the earnings in that year are not covered for C/QPP purposes. A two-earner couple with total earnings of $20,000, on the other hand, will ultimately receive a pension in respect of all their earnings in that year. (As Figure 4 indicates, it is assumed that in the two-earner couple case one spouse earns two-thirds and the other one-third of the couple's total earnings. In the $20,000 example cited above this puts each below the YMPE.)

Figure 4 shows that the pension system maintains a smaller proportion of pre-retirement living standards of those who are single throughout the lives than it does of one-earner couples (the Base Definition). The principal reason for this is the availability of only one rather than two OAS pensions in retirement. (The horizonal axis of Figure 4 does not report pre-retirement consumption levels since these are different for each of the three cases shown.)

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(4)The progressivity of the income tax rate schedule means that when a given amount of earnings is taxed in the hands of two people, income taxes are lower than if all the earnings were taxed in the hands of one of them. C/QPP contributions are lower in the two-earner couple case since each partner receives the benefit of the Year's Basic Exemption (YBE).

D. Homeownership

The larger a pension plan the lower the pre-retirement consumption and the higher the post-retirement consumption of the plan's participants and, therefore, the greater the extent to which pre-retirement living standards are maintained in retirement. As Chapter IV indicated, homeownership has the same effect; the savings embodied in a home reduce pre-retirement consumption and the consumption of the 'imputed rent' in the post-retirement period raises consumption in comparison with the no-saving case.

FIGURE 5
Extent to Which Pre-Retirement Living Standards are Maintained After Retirement by the OAS and the C/QPP

Base Definition and Homeownership Case

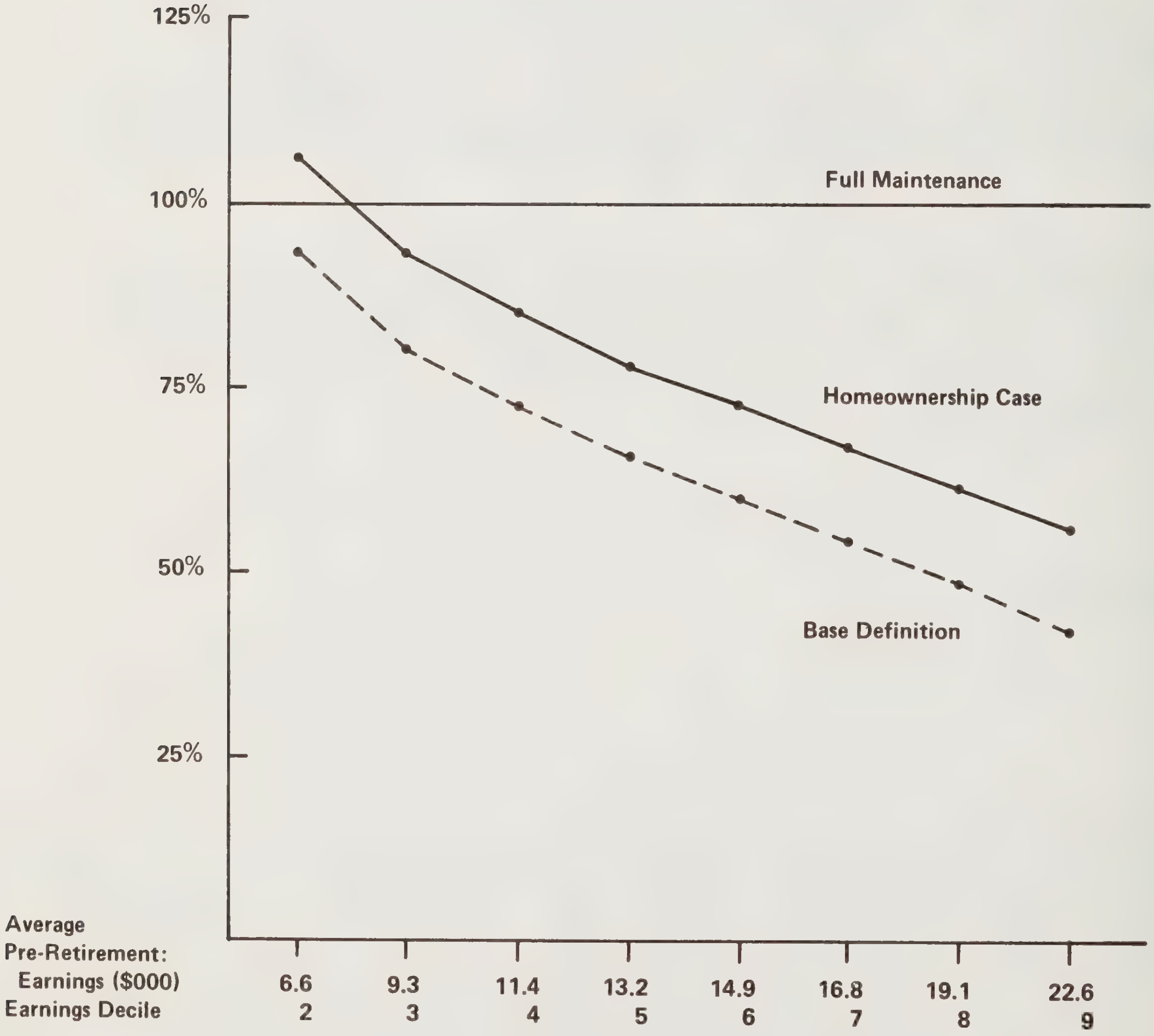


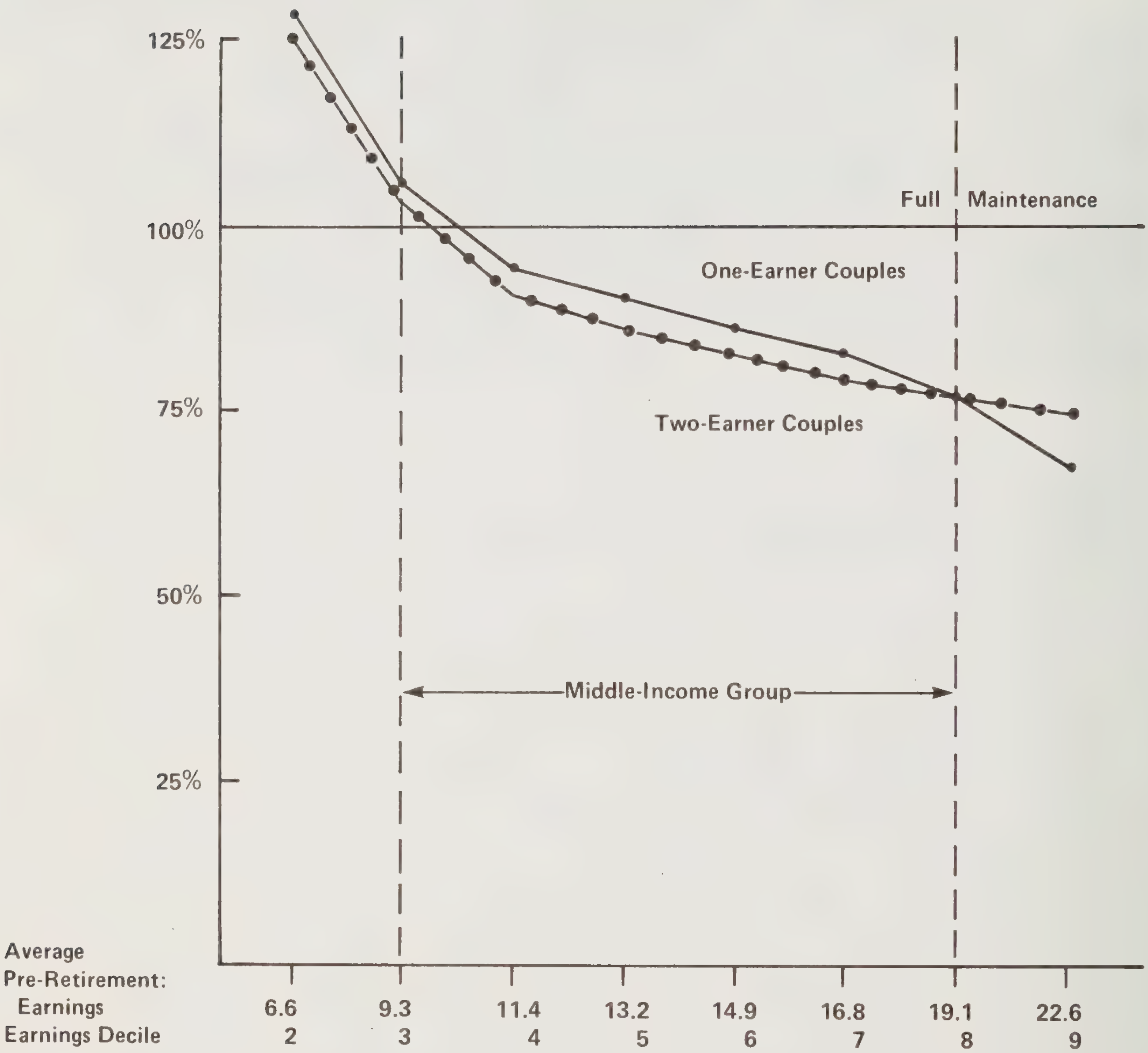
Figure 5 shows the effect of homeownership on the extent to which pre-retirement living standards are maintained by the illustrative pension system. As noted in Chapter IV, it was assumed that homes owned by those who are retired are disposed of by bequest after the death of the last surviving spouse.

E. An Enlarged Mandatory Earnings-Related Pension Plan: One-and Two-Earner Couples

Of the various elements examined in this appendix, the two-earner couple case is of particular interest given the rising rate of labour force participation among married women. Figure 6 shows the extent to which a pension system containing the OAS (indexed to AWS) and an earnings-related pension plan that replaces 40% of average (adjusted) pre-retirement earnings up to 1.5 times AWS maintains the pre-retirement living standards of one-earner and of two-earner couples. Note that when the YMPE = 1.5 AWS the 'cross over' noted in Figure 4 occurs at a higher earnings level. The Figure 6 results include the GIS. Thus, Figure 6 may be compared with Figures IV-2 to IV-4 in Volume 1 of the Task Force report. Those in the second and third deciles receive GIS; those in the remaining deciles pay small amounts of income tax in retirement.

FIGURE 6
Extent to Which Pre-Retirement Living Standards are Maintained After Retirement by the OAS and a 40% Pension(1)

One-Earner Couples and Two-Earner Couples



(1) Pension replaces 40% of average (adjusted) pre-retirement earnings up to 1.5 AWS.

F. Conclusion

The extent to which a given pension system maintains the pre-retirement living standards of its participants depends on the definition of 'the maintenance of living standards', the marital and labour force status of its participants and the extent to which its participants save privately. This appendix has given some indication of the extent to which changes in these elements produce changes in the extent to which a given pension system maintains pre-retirement living standards.

APPENDIX 7

THE DISCRIMINATORY EFFECT OF CERTAIN FEATURES OF EMPLOYER-SPONSORED DEFINED BENEFIT PENSION PLANS

Alan Puttee*

A. Introduction

By their very nature, defined benefit pension plans embody some inherent features which, together with other design provisions that are often adopted, result in discriminatory treatment of plan members in essentially similar situations.

A simple computer model was developed to illustrate the extent to which certain design features generally typical of defined benefit plans found in the private and public sectors unfairly discriminate against individuals whose work experience has been basically the same. In this appendix, three particular design features that bring such results are examined: the earnings bases adopted under defined benefit plans for purposes of determining benefits, the vesting requirements and certain provisions governing early retirement.

It should be noted that some differences in pension plan results are quite appropriate and widely accepted. For example, a retired member of a pension plan who draws benefits until his death at age 90 obviously receives more than a person in otherwise identical circumstances who dies at age 70. But that difference in treatment is entirely in accord with the principal aim of a pension, which is to provide income to maintain an individual from the time of his retirement until his death. Of course, if one plan contained identifiable groups whose mortality experience consistently differed, questions could be raised concerning the equity of requiring the same contribution from all members and paying what amounts to different benefits to the different groups. Differences associated with mortality experience are not examined here, but it might be noted that they are more likely to be a cause for concern when occupational groups with differing mortality experience were grouped under one plan than when males and females - whose mortality experience differs - were similarly grouped. A related difference in treatment is associated with survivorship provisions which clearly render a pension plan more valuable to a married plan member than to his single counterpart (provided employee contributions and/or compensation is not dependent on marital status). What might constitute appropriate survivorship provisions is a contentious issue in itself and is discussed separately in this report. The focus of this appendix is, instead, on three features of defined benefit plans that have discriminatory effects which are considered to be inappropriate.

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* Task Force on Retirement Income Policy. Department of Finance. The assistance of G. Bissonnette and M. Cappe of the Treasury Board Secretariat is gratefully acknowledged. Responsibility for the paper is that of the author.

The amount of pension paid under many defined benefit plans is based on earnings received at or near the end of an individual's working life. A typical example is a '1 1/2% best five-year average earnings' plan. Such a plan obviously provides a clear advantage to those whose earnings are very much higher at the end of their career than at the beginning. An important question of equity is raised if a plan of this nature covers, for example, two occupational groups - one which receives relatively flat lifetime earnings, such as assembly line workers, and another which receives earnings that rise relatively steeply during their working life, such as professionals. In this case, a plan which provides pensions based on best five-year average earnings quite clearly favours the latter group by providing higher benefits in relation to contributions made.

There are two aspects of vesting provisions which can give rise to discriminatory treatment. The first concerns the period of service and age requirement necessary to qualify for vested benefits. Where vesting provisions are less than full and immediate, mobile workers will generally fare less well in pension terms than workers who remain in one plan. How appropriate are vesting requirements which provide a deferred pension to one worker leaving a plan after ten years of service and provide nothing (other than a return of contributions plus interest in the case of a contributory plan) to another worker who leaves after nine years service? While employers may have their own reasons for designing plans in this way, it is questionable whether such discriminatory treatment should be permitted by public policy.

The second concern in this area relates to the period of an individual's career in which a vested pension right is acquired, since it can significantly affect the amount of benefit ultimately received in relation to the amount of contributions paid into the plan by an employee. The point may be illustrated by taking the case of a plan which provides a pension equal to 2% of career average earnings for each year of service. The estimated cost to the employer of providing the benefit earned in the year by an employee aged 30 may amount to around 3% of his wages. But to provide the same benefit earned in that year by an employee aged 64 may cost the employer an amount equal to some 20% of his wages. The difference in cost to the employer of providing for an identical benefit earned in the year in question results from the fact that the contributions of both the employer and the employee can accumulate earnings for a period of 34 years in the case of the 30-year-old, but those in respect of the 64-year-old worker will accumulate earnings for only one year prior to his retirement. It is apparent, therefore, that the amount of pension benefit earned by the employee aged 64 in relation to his contribution to the plan is significantly higher than that of the 30-year-old employee. Even if all members of the labour force were members of pension plans continuously, in the absence of provision for full and immediate vesting, those who failed to achieve vested status for periods near the end of their careers would, other things being equal, derive less benefit in relation to their contributions than those who failed to acquire vesting during periods near the beginning of their careers.

The third design feature examined which can have discriminatory effects is the early retirement provisions contained in some plans under which an employee, at his own discretion and usually after a prescribed number of years of service, may cease to work at less than the normal pensionable age set by the plan, but still draw an unreduced pension, that is, one based on the plan's benefit formula. Based on normal life expectancy, such a plan member would receive larger pension benefit payments than those members who began drawing pensions only after reaching the normal retirement age.

B. Total Compensation

It can be argued that the differences in treatment of plan members resulting from these three design features of defined benefit pension plans are of little concern since they reflect deliberate differences in treatment of employees by employers. If the employer were not permitted to provide for such differences of employee treatment through the pension plan, it might be contended, then he would achieve the same objective through some other component of the compensation package. In the absence of a pension plan, for example, an employer wishing to construct an incentive for employees to remain with his firm after a 'learning-on-the-job' training period which lasted, say, five years, could establish wage scales to achieve that result. In this case, the employer would provide rapidly increasing wages after the fifth year. If a pension plan was subsequently established by this employer, he might simply smooth out his wage scales and inaugurate a five-year vesting régime. As a result, the extra benefit designed to retain trained employees would be the promise of a pension on retirement, rather than higher wages. The argument that these differences in pension plan treatment are consciously devised by employers to achieve a specific objective - an objective that might be achieved in different ways if the pension plan was required to mete out more 'neutral' treatment - could also be made with respect to the differences in treatment occasioned by the use of certain earnings bases and certain early retirement provisions.

It is most unlikely that the differences in pension plan treatment actually reflect a carefully calculated policy based on the total compensation approach. As is noted below, for example, pension outcomes - particularly in respect of those who have left the plan and carry with them a deferred pension - vary significantly with the rate of inflation. If the employer carefully calculated the pension benefits as part of a total compensation package, one would expect to find adjustments to the value of deferred pensions or some other compensating payment to terminated employees during inflationary periods. However, compensation of this sort virtually never occurs.

A second point to note is that it is widely accepted that governments need to regulate the design of pension plans. For example, it is no longer possible for most employers in Canada to establish vesting provisions that deny pensions to long-service employees. The so-called '45 and 10' provisions have the effect of restricting the employer's ability to use the pension plan to effect differences in the

treatment of employees. The wide acceptance of government regulation in this case would suggest that the key question is not whether legislation and regulation should narrow the scope for employer choice of plan design, but how stringent such legislation and regulation should be.

The discussion that follows does not take account of the total compensation point outlined above. Since, in the absence of pension plans, some of the reported differences in treatment may arise in other forms, the results below may overestimate the effect of pension plans.

C. The Model

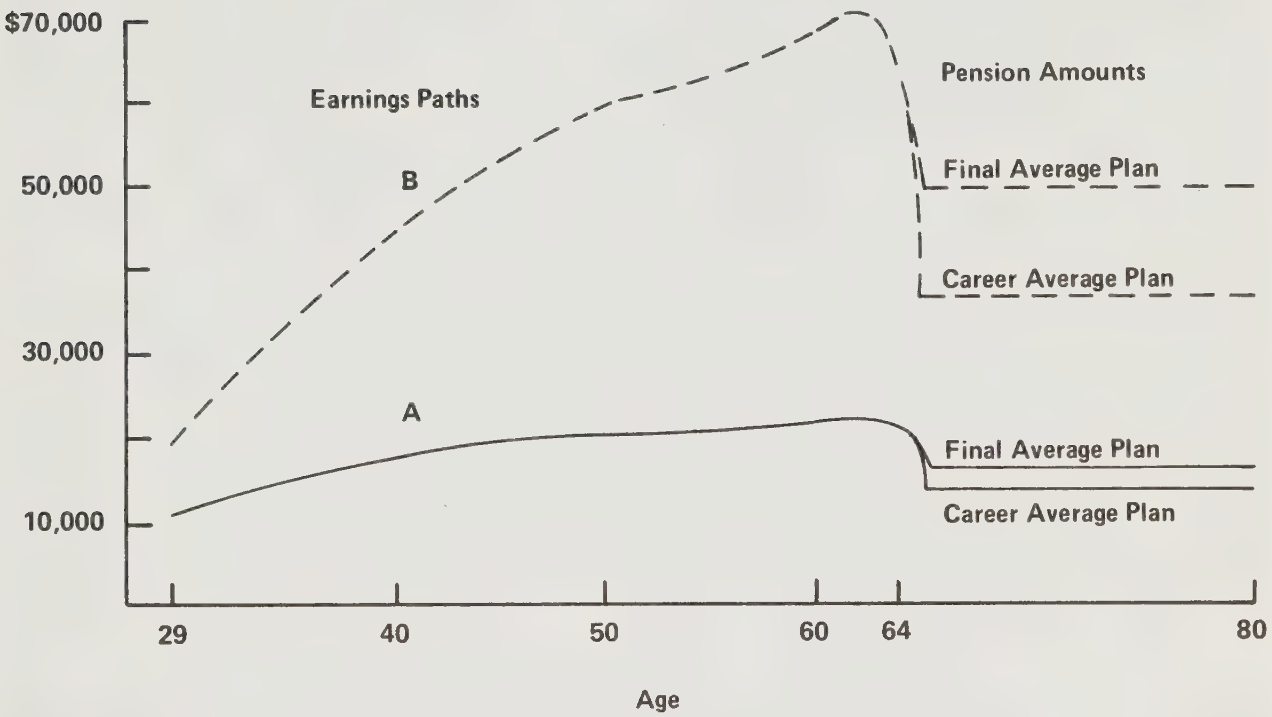
As indicated earlier, a simple computer model was constructed to examine the size of the differences in pension outcomes that could typically be associated with the three design features noted above. Two broadly typical pension plans and a series of earnings profiles derived from cross-sectional census data were drawn on for purposes of this analysis.

The two pension plans chosen for examination were a 2% career average plan and a 2% final five-year average plan. Neither is integrated with the C/QPP. Each plan requires employee contributions of 5% of annual earnings. When an employee leaves the plan before achieving vested status, he receives a return of his past contributions together with interest calculated as amounting to three-quarters of the market rate of interest. Vesting in some plans occurs after nine years, but in others only after ten.

Two earnings paths are examined. The first, A, is derived from earnings data of males with little formal education (less than grade 9); the second, B, is derived from earnings data of males with a university degree. It is assumed that no deaths occur during the working period; each individual stops working at age 65 and lives in retirement for a further period of 15 years. The diagram below portrays earnings paths A and B and the pensions of those who spend all 36 years in one plan.

FIGURE 1

Pensions from Career Average and Final Average Plans of Long-Service Employees(1)



(1)See text for an explanation of earnings path for A and B.

The first part of the analysis is simplified by assuming that all individuals work from their 29th birthday to the day before their 65th birthday - a total of 36 years. Those individuals who do not spend all of their career in one plan move through four plans, spending nine years in each. When the nine years is spent in a plan with a ten year vesting requirement, vested status is not achieved.

In order to compare the pension outcomes of individuals in different situations, the streams of contributions to and benefits from pension plans have to be valued as at a single point in time. To achieve

this, the present values of the streams of contributions and benefits are calculated using a discount rate which is set equal to the assumed market rate of interest. The ratio of the present value of benefits to the present value of contributions is then adopted as the yardstick by which to measure benefits received in relation to contributions made. The higher the ratio (which is termed the benefit/ contribution ratio), the more advantageous the plan to the participant.

The benefit/contribution ratio may be more readily understood through the use of a few examples. If an individual annually deposited a constant percentage of his earnings in a bank savings account until he was 65 and then withdrew the accumulated capital and interest earned at the market rate to purchase an annuity, the ratio of the present value of his benefits to the present value of his contributions would be equal to 1. That is the case because the amount that he receives back through the annuity (assuming his life expectancy is average) is equal to the amount of income he set aside during his working years plus accumulated interest.(1) If instead of making regular deposits in a bank this same individual regularly contributed throughout his career to a defined contribution plan which required matching contributions by his employer, the benefit/contribution ratio resulting from the annuity purchased at retirement with the accumulated capital and interest earned at the market rate would be 2 - given the matching employer contribution; the individual gets back in benefits twice what he contributed. In the case of defined benefit plans, however, the benefit/contribution ratios of individuals will vary widely, depending on such factors as their earnings profile, mobility patterns, vesting provisions, and the period in which vesting is achieved.

When a member leaves a plan before having acquired vested status, it is assumed for purposes of this discussion that the contributions returned to him, together with the interest paid by the employer on those contributions, are subsequently invested at the market rate of interest and that accumulation converted into a life annuity at age 65. As a result of the assumption previously stated that the interest paid by the employer on contributions returned to a departing employee who failed to achieve vested status amounts to only three-quarters of the market rate, it will be evident that the benefit/contribution ratio of the individual during a period in which vesting is not achieved will amount to less than 1. In other words, the employee in this case would have been better off by making regular deposits in a savings account that earned the market rate of interest than making contributions to a pension plan where, as it turned out, his contributions earned only three-quarters of the market rate. When vested status is achieved in

(1)This is true only if the rate used to discount the stream of contributions and benefits in order to arrive at present values is equal to the rate of return earned on contributions and to the rate of return embodied in the annuity which the contributions are used to purchase.

respect of all 36 working years, the 'benefits' that make up the numerator in the benefit/contribution ratio consist of pension payments only. In cases where vesting is not achieved, benefits include payments received from a private annuity purchased with return of pension contributions previously made and accumulated interest.

In the initial part of the analysis, two sets of cases are examined. In the first, wages are assumed to grow at 2% per year (in addition to the growth/decline characterizing the earnings profile); the rate of interest is assumed to be 3 1/2%. The annual rate of inflation is assumed to be zero. The second set of cases assumes 3% inflation. This is fully reflected in the interest rate, which becomes 6.605%.(2) It is also reflected in wages and salaries, which increase at the rate of 5.06% a year. The discount rate used in calculating present values is set to equal the interest rate. Deferred pensions and pensions-in-pay, however, are left denominated in money terms - that is, the pension plans are not adjusted for inflation.

D. The Interaction of Inflation and Early Plan Membership on Benefit/Contribution Ratios

Before proceeding further, it is necessary to examine a factor that creates complications in determining benefit/contribution ratios. It has already been pointed out that the ratio is low for young employees and high for older employees due to the longer period over which interest accumulates on contributions. As noted, young employees who subsequently terminate entail little or no pension cost for their employers. A second element comes into play in an inflationary environment if the terms of a pension plan are not adjusted to take account of it. Under those circumstances (and assuming that interest rates fully reflect inflation), the benefit/contribution ratio will be lower than if there were no inflation.

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(2)With an interest rate of 6.605%, $1 invested at the beginning of the first year rises to $1.06605 at the beginning of the second year. If the rate of inflation over the period is 3%, then at the beginning of the second year $1.03 is required to purchase the same amount of goods and services at $1 did at the beginning of the first year. Thus, a person investing $1 at the beginning of the year which earns 6.605% interest during a period when inflation is 3%, ends up at the beginning of the second year with ($1.06605 ÷ 1.03 =) $1.035 in real dollar terms. In real terms, the investment of $1 produced a return of 3.5 cents. Thus, an inflation-adjusted rate of return of 3.5% implies, with 3% inflation, a nominal interest rate of 6.605%. Similar relationships apply in respect of the rate of growth of earnings.

The effect of the interaction of these two elements is to produce very low benefit/contribution ratios for those who achieve vested status in an unindexed, defined benefit plan early in their careers and who choose or are required to accept a deferred pension on termination of employment, rather than receiving a return of past contributions. In fact, in many cases the ratio may fall below 1, indicating that the individual is worse off for having been a member of a plan than if he had invested privately. Since the analysis that follows reflects the result of this interaction, it may be helpful to illustrate the way in which it works through a very elementary (and exaggerated) example, details of which are contained in Table 1.

Assume that an individual's career lasts three years and retirement lasts one year. In each working year the individual is in a different career average plan, but all three plans are identical. The plan promises benefits of 25% of average earnings for each year of service. The individual's earnings in the first year are $10,000 (paid at the beginning of the year). His earnings increase at the rate of 50% in each of the following two years. The annual rate of interest is 50%. Employee contributions are 5% of earnings. Vesting is full and immediate. There is no inflation.

In the first year, the employee contributes 5% of his earnings - $500 - and, in return, establishes eligibility to a $2,500 pension to be paid at the end of three years. The present value of the employee's contribution is $500. The present value of the benefit to be received in three years time is arrived at through the use of a discount rate which is set equal to an assumed annual rate of interest of 50%. The present value of the benefit in the first year, therefore, is $\frac{\$2,500}{(1.5)^3} = \$741$. As a result, the benefit/contribution ratio is $\frac{\$741}{\$500} = 1.48$

If it is now assumed that annual inflation amounts to 50% and that it is fully reflected in the future increase of wages and interest rates, then the outcome is changed substantially. Contributions and their present value in the first year remain at $500. Benefits earned in the first period remain at $2,500. But the present value of those benefits is greatly reduced as a result of the higher discount rate which reflects the higher nominal interest rate. The present value of the benefit amounts in this case to only $219, compared to $741 in the no-inflation case; the benefit/ contribution ratio is reduced from 1.48 to .44.

Table 1

Benefits and Contributions Arising from Membership in Three Identical Career Average Plans in Three Years

Year	Earnings	Benefits	Present Value of Benefits	Contributions	Present Value of Contrib.	Present Value of Benefits / Present Value of Contrib.
	$	$	$	$	$	
			No Inflation			
1	10,000	2,500	741	500	500	1.48
2	15,000	3,750	1,667	750	500	3.33
3	22,500	5,625	3,750	1,125	500	7.50
			50% Inflation/Year			
1	10,000	2,500	219	500	500	.44
2	22,500	5,625	1,111	1,125	500	2.22
3	50,625	12,656	2,500	2,531	500	5.00

The last column in the no-inflation case in Table 1 indicates that the benefit/contribution ratio is quite low (at 1.48) for a plan member who spends year 1 in the hypothetical career average earnings plan and then leaves it. But the ratio is higher in the later periods. The last column in the inflation case indicates a similar progression, but at substantially lower levels. The benefit/contribution ratio for the first period is well below 1 - that is, well below what the member could have achieved by investing an amount equal to his own contributions. Thus, membership in the defined benefit plan where the value of the deferred pension ($2,500) is not indexed between termination and retirement is clearly not advantageous for the young and mobile member.(3)

E. Earnings Bases, Vesting Régimes and Early Retirement

The above example, of course, is totally hypothetical. Table 2 below displays benefit/contribution ratios derived from the model described previously. Results are presented for two earnings profiles, A and B, described earlier, for pension plans with different earnings bases and vesting provisions, and for several mobility patterns. The benefit/contribution ratios contained in Table 2, and also in Table 3, are based on 36 years of contributions (and, in some cases, savings) and 15 years of pension (and, in some cases, annuity) payments.

(3)Of course, if the employee's wage or salary is lower as a result of the pension plan, a loss arises not only as a result of a benefit/contribution ratio less than 1, but also as a result of the wage/salary forgone.

Table 2

Benefit/Contribution Ratios for Career Average and Final Average Plans for those with Flat (A) and Steep (B) Earnings Profiles and Varying Mobility Patterns. No Inflation and 3% Inflation Cases

	1 Career Average Plans		2 Final Average Plans	
	No Inflation	3% Inflation	No Inflation	3% Inflation
Flat Earnings Profile (A)				
Membership in one plan for 36 years	2.5	1.3	2.9	2.2
Membership in four plans, 9 years each				
- Fully vested in four plans	2.5	1.3	2.6	1.4
- Misses vesting in first plan	2.3	1.5	2.4	1.5
- Misses vesting in last plan	2.0	1.0	2.0	1.0

	3 Career Average Plans		4 Final Average Plans	
	No Inflation	3% Inflation	No Inflation	3% Inflation
Steep Earnings Profile (B)				
Membership in one plan for 36 years	2.7	1.5	3.5	2.7
Membership in four plans, 9 years each				
- Fully vested in four plans	2.7	1.5	2.8	1.6
- Misses vesting in first plan	2.5	1.6	2.6	1.7
- Misses vesting in last plan	2.0	1.0	2.1	1.1

Comparing the benefit/contribution ratios for the several cases portrayed in the table reveals a good deal of the source and magnitude of the differences in treatment that defined benefit plans can occasion for their members.

1. <u>Earnings Bases</u>. The effect of the earnings bases utilized by plans on pension outcomes is shown by comparing, for the long-service members, the benefit/contribution ratios in parts 1 and 3 and parts 2 and 4 of the table. When those with steep or flat earnings profiles spend their careers in one career average pension plan, the benefit/contribution ratios are similar (2.7 compared to 2.5 in the no-inflation case). However, when membership is in a final average plan, a much more substantial difference in outcome emerges dependent on the individual's earnings profile. In a final average plan without inflation, the benefit/contribution rate for B is 3.5, whereas it is only 2.9 for A. In the inflation case, similar relationships obtain. In each case, the ratios are reduced by inflation.

2. <u>Vesting Régimes and Employee Mobility</u>. The figures in the lower half of each of the four parts of the table focus on outcomes arising from various vesting régimes and mobility patterns. The first point to note is that for a given mobility pattern, the pension outcomes are similar whether plans are career average or final average, and are also similar whether earnings path A or B is involved. This observation simply serves to underline the fact that when there is movement through a number of final average plans, pension outcomes approach those associated with career average plans. Note that the individual who achieves vested status in each of the four final average plans to which he belongs during his working life fares less well than his counterpart who spends his entire career as a member of one final average plan. This comes about because the deferred pensions he earns under the first three plans to which he belonged are based on the final average of his earnings at the time he terminated employment, whereas the pension of his immobile counterpart is based entirely on final average earnings at the end of his career. As a result, the outcome for the person who achieved vested status in four final average plans is more akin to that of the individual in the career average plan who is either a member of one plan throughout his working life or acquires vested status in four different plans.

When part of a career is spent in a plan where vesting is not achieved (and there is no inflation), pension outcomes are less favourable than when vesting is achieved. Compare, for example, the benefit/contribution ratios in part 1 of the table. If A encounters a plan with a ten year vesting requirement at the beginning of his career, he fails to achieve vested status in that plan since, by assumption, his tenure in the plan is only 9 years. If vesting is achieved in the remaining three plans he joins, his lifetime benefit contribution ratio is 2.3. Had he achieved vesting in all four plans, his benefit/contribution ratio would have been 2.5. Similar differences are evident in the other cases portrayed.

As the highly simplified example in Table 1 made clear, the <u>period</u> of the career when vesting is not achieved significantly affects the benefit/contribution ratios. Part 1 of Table 2 indicates that if vested status is not achieved in the <u>final</u> nine year period of the career, A's benefit/contribution ratio is 2.0, significantly below the 2.5 he would have received had he vested in the last plan. An examination of the four parts in Table 2 indicates that, compared to the situation where vesting is achieved in all four plans, the reduction in the benefit/contribution ratio is in the order of two to five times greater when the

period of non-vested status occurs at the end of the career than when it occurs at the beginning.

When inflation is not accounted for in defined benefit plans, the benefit/contribution ratios fall dramatically. However, as expected, the member who spends all his career in a final average plan is damaged less by inflation than is his counterpart who spends his working life in a career average plan. The former benefits from what might be called 'automatic pre-retirement indexing' that results from the calculation of benefits on final average earnings which reflect the impact of inflation. (Compare the drop in the benefit/contribution ratio from 2.9 to 2.2 in part 2 to the much larger drop from 2.5 to 1.3 in part 1.) When attention shifts to the mobility cases, however, the pension outcomes from the two types of plans are similar, reflecting the fact that from whatever plan an unindexed deferred pension is produced, its value will be similarly eroded by inflation. (Compare for example, the benefit/contribution ratios in parts 1 and 2 of the table in the 'fully vested in four plans', 3% inflation case: 1.3 vs 1.4.)

When inflation occurs and is not offset through plan adjustments, those mobile employees who miss vesting in the first plan and achieve vested status in the last three actually do better in pension terms than do their counterparts who achieve vesting in all four plans. This comes about because the individual receiving a return of contributions following termination of employment is able to invest them privately in securities that offer the market rate of return, which itself reflects the impact of inflation. (Compare benefit/contribution ratios of 1.5 and 1.3 in part 1 of the table.) These results indicate that for mobile employees, achieving vested status in unindexed defined benefit plans in the early part of the career can be extremely disadvantageous if a deferred pension is chosen over a return of contributions and if inflation does occur.(4)

The worst of all possible cases considered occurs when mobile employees face inflation and when vesting is achieved in the first three of the four plans (creating the loss situation referred to above in respect of the first plan) but missed in the last plan, when the employer contributions would have been substantial. In each of the four parts of Table 2 the benefit/contribution ratio in this case is at or close to 1, indicating that, on a lifetime basis, the individuals concerned are effectively receiving only a return of their own contributions. In these extreme cases, the employee has, in total, received nothing in pension benefits from his employer, while at the same time likely also having been paid lower wages or salaries because of the existence of the plan than would have prevailed in the absence of a plan.

These results indicate that, for mobile employees, pension outcomes can vary significantly when vesting is not full and immediate. Moreover, the period of the career when vesting is achieved significantly affects pension outcomes. If inflation is present and plans are not

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(4)In some jurisdictions an effort is made to ensure that the expected value of a deferred pension is not less than the value of the employee's own contributions.

indexed, benefit/contribution ratios fall. Long-service members of final average plans are better protected than their counterparts in career average plans. Inflation can very seriously damage the pension outcomes of mobile employees; for young employees who do not stay with the employer, pension plans can be disadvantageous.

3. Early Retirement Provisions. Pension plans are required to establish a normal pensionable age. It is at this age that pensions based on the pension formula come into pay. Some plans also establish an earlier age at which (usually only long-service) employees can choose to retire and receive a pension which is not actuarially reduced, i.e. one based on the plan formula. When entitlement to these pension benefits is made available to some employees at earlier ages than others, the relative treatment of employees as measured by the benefit/contribution ratio differs substantially. Based on life expectancy, those who retire early on an unreduced pension will draw substantially higher total benefits than those who retire later.

One way to indicate the magnitude of the differences in treatment that such provisions can entail is to compare the benefit/contribution ratios for individuals who all spend 30 years contributing to a pension plan. One group, however, works between the ages of 35 and 64 for the employer in question. The other group works between the ages of 25 and 54 for the same employer. The employer-sponsored pension plan contains an early retirement provision under which employees with 30 years service can retire at age 55 and receive a pension based on the pension formula (i.e. 2% of career average or final average earnings per year of service) - that is to say, the early retirement provision provides eligible employees the right to choose an unreduced pension at age 55.

Table 3 below shows the effect that early retirement provisions of this kind can have on the benefit/contribution ratios of members of career average or final average pension plans who have flat or steep earnings profiles. It is assumed that those who are eligible do retire early. The flat (A) and steep (B) earnings profiles underlying Table 3 are the same as those referred to previously. In the case of each earnings path, one group is considered to put in 30 years of work between the ages of 25 and 54, retiring at age 55, while the other group works for the same number of years between the ages of 35 to 64, retiring at 65.

Table 3

Comparison of Benefit/Contribution Ratios of Employees Retiring at Ages 55 and 65

	Benefit/Contribution Ratios	
	Career Average	Final Average
Flat Earnings Profile (A)		
Career Period		
35-64	2.8	3.1
25-54	3.6	4.5
Steep Earnings Profile (B)		
Career Period		
35-64	2.8	3.4
25-54	3.9	5.8

Table 3 shows that those working for the age 25-54 period always do better in pension terms than those working for the age 35-64 period. The differences vary by earnings path and type of plan. The early retirement provision represents a larger bonus for those in final average plans than for those in career average plans. In addition, those with steep earnings paths who retire early reap greater advantages than those with flatter earnings paths. Thus, as the table shows, an individual with a steep earnings profile in a final average plan who retires early enjoys a benefit/contribution ratio of 5.8, while the benefit/contribution ratio of his colleague who is the same in every way - except as to the timing of his career with the employer - is 3.4, fully 40% lower.

F. Conclusions

The several examples presented above indicate that individuals who are in similar circumstances except for the shape of their career earnings paths, their mobility patterns, and timing of their careers with a particular employer may be accorded very different treatment by employer-sponsored pension plans when they are of the final average kind, when they employ less than full and immediate vesting and when they offer certain early retirement provisions. When inflation is present and no adjustment is made to offset its effects, the pension position of plan members is damaged; the impact of inflation depends on the way in which it interacts with some of the factors just outlined.

Two final comments may help put the foregoing in some perspective. First, the differences in treatment of employees arising from differences in their earnings paths, the period of non-vested status and the period

of the career spent with a particular employer do not arise when pension plans are of the defined contribution kind. As long as vesting is achieved and interest rates reflect inflation, benefit/contribution ratios for contributory defined contribution plans where the employer matches the employee's contributions, are always equal to 2.

Second, it should be noted that the public earnings-related pension plans, the C/QPP, are designed so as to avoid each of the difficulties examined in this appendix. The earnings base is of the career average kind, vesting is full and immediate, and there is no access to unreduced pension benefits before age 65.

APPENDIX 8

INTERACTION OF LABOUR MOBILITY RATES AND VESTING RULES ON YEARS OF PENSIONABLE SERVICE

Raymond Préfontaine and Yves Balcer*

A. Introduction

Employer-sponsored pension plans in Canada generally contain vesting rules, based on age and years of service, which have to be met before pension benefits are vested in a terminating employee. The stringency of the pension rules applicable in pension plans will therefore determine the number of years of pensionable service which will be vested in the employees. At one extreme the rules may be very liberal such that all years of service with a particular employer or group of employers enter into the calculation of the pension no matter at what age the employee terminates a job. A familiar example of such a vesting rule is found in the Canada/Quebec Pension Plans (C/QPP) where all service in covered employment is immediately and irrevocably credited to the employee. At another extreme, one could conceive of extremely stringent vesting rules, say, for example, that a terminating employee has to have 20 years of service and be aged 60 before pension benefits are vested. Under such a rule, relatively few Canadian employees who terminate a job would meet these conditions and hence receive a pension from a former employer.

Generally, in Canada, the minimum compulsory vesting rule is "45 and 10", that is, a terminating employee who is aged 45 or more, and has 10 or more years of credited service with his or her employer is entitled to receive a pension benefit payable at the retirement age specified for the pension plan. It should be noted that "45 and 10" is the minimum compulsory rule. Many pension plans contain optional, less stringent requirements. For example, the Public Service Superannuation Plan permits employees with five or more years of credited service, irrespective of age, to elect, at their option, for a deferred pension instead of a return of contributions. Employees terminating from a job covered by a non-contributory plan of course receive nothing if they do not meet the vesting conditions.

For an individual employee, the more frequent the job changes the less the likelihood that he or she will meet the vesting conditions. Similarly, for the labour force as a whole, and given certain vesting rules, the greater the amount of labour mobility, i.e. the frequency of job changes, the fewer the number of individuals who will meet the

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vesting standards and hence receive pension benefits. Conversely, for a given amount of mobility in the labour force, the more liberal the vesting rules the greater the number of employees receiving benefits.

This appendix summarizes a study(1) of the amount of mobility in the labour force and its interaction with vesting rules on the number of employees who can be expected to receive pensions. With the aid of a simulation model other factors which may impact on the number and size of pensions, for example the number of employees who are covered by pension plans (the coverage ratio) are studied. As well, the distribution of pension benefits among retirees is examined. This distribution is measured in different ways, for example by measuring the number of employees who will receive pensionable years of service of 40 to 45 years, 35 to 40 years, etc. down to the percentage of employees in Canada who can expect to receive no benefits because of their too frequent job changes. By making assumptions as to salaries and benefit rates it was also possible to examine the distribution of replacement ratios, that is the value of the pension benefits relative to pre-retirement earnings.

B. Data on Tenure and Job Mobility in the Canadian Labour Force

To estimate the probable amount of pensionable service which employees are likely to receive it is necessary to have data from which the probable worklife pattern of the labour force can be estimated. This worklife pattern can be estimated in turn by examining the behaviour of a large sample of individuals and counting the numbers who leave their job, at a given age, and with a given tenure, relative to those who stay. With this ratio, known as the termination rate, and with additional information on their probable movements it is then possible to estimate probable worklife patterns and the expected pensionable years of service given various vesting rules.

This is an analogous procedure to that used by actuaries to calculate mortality tables. A large sample of individuals of different ages is examined to see how many die within a year relative to the total at each age. The ratio of those dying within a year to those living at the beginning - the death rate - can then be used to calculate such things as the expectation of life at a given age, the probability of dying in a given year, etc.

The essential differences in calculating termination rates for this study are that firstly, the probabilities of leaving or staying in a job are functions of both age and tenure, instead of age only as in mortality tables. Secondly, mortality tables assume only two possible states: that an individual can be alive in one period and either alive or dead in another period. Termination rates derived in this study were more complex in that five possible states were assumed: (1) a full-time

(1)Préfontaine, R. and Balcer, Y. Job Mobility and its Implications for the Employer-Sponsored Pension System in Canada. A study undertaken for the Task Force on Retirement Income Policy, Department of Finance, Ottawa, September 1977 (Mimeo).

job in the public sector; (2) a full-time job in the private sector; (3) part-time employment; (4) unemployment/not in the labour force; and (5) self-employment. From one period to another, an individual can move among any one of these five states or stay in his current status.

Using the monthly data collected by Statistics Canada for its Labour Force Survey over the period March 1976 to March 1977, it was possible to estimate the probabilities of moving from one status to another. This was done by linking each individual's response as to length of time he had spent in a given status (e.g. 60 months with his current public employer) to the same individual's response to the same question in the second month. If, continuing the example, he reported one month of tenure with a private sector employer in the second month it was assumed that he had changed his job. This same procedure was followed for over 300,000 records of males, aged 20 to 64. Counting all these flows established the probable monthly paths between states at a given age and tenure, i.e. monthly transition matrices. These monthly transition matrices were then converted into annual transition matrices, and used to calculate the expected amount of pensionable service a male entering the labour force at age 20 could expect to receive by the end of his 64th year, given various vesting rules based on age and service as well as differing pension coverage ratios.

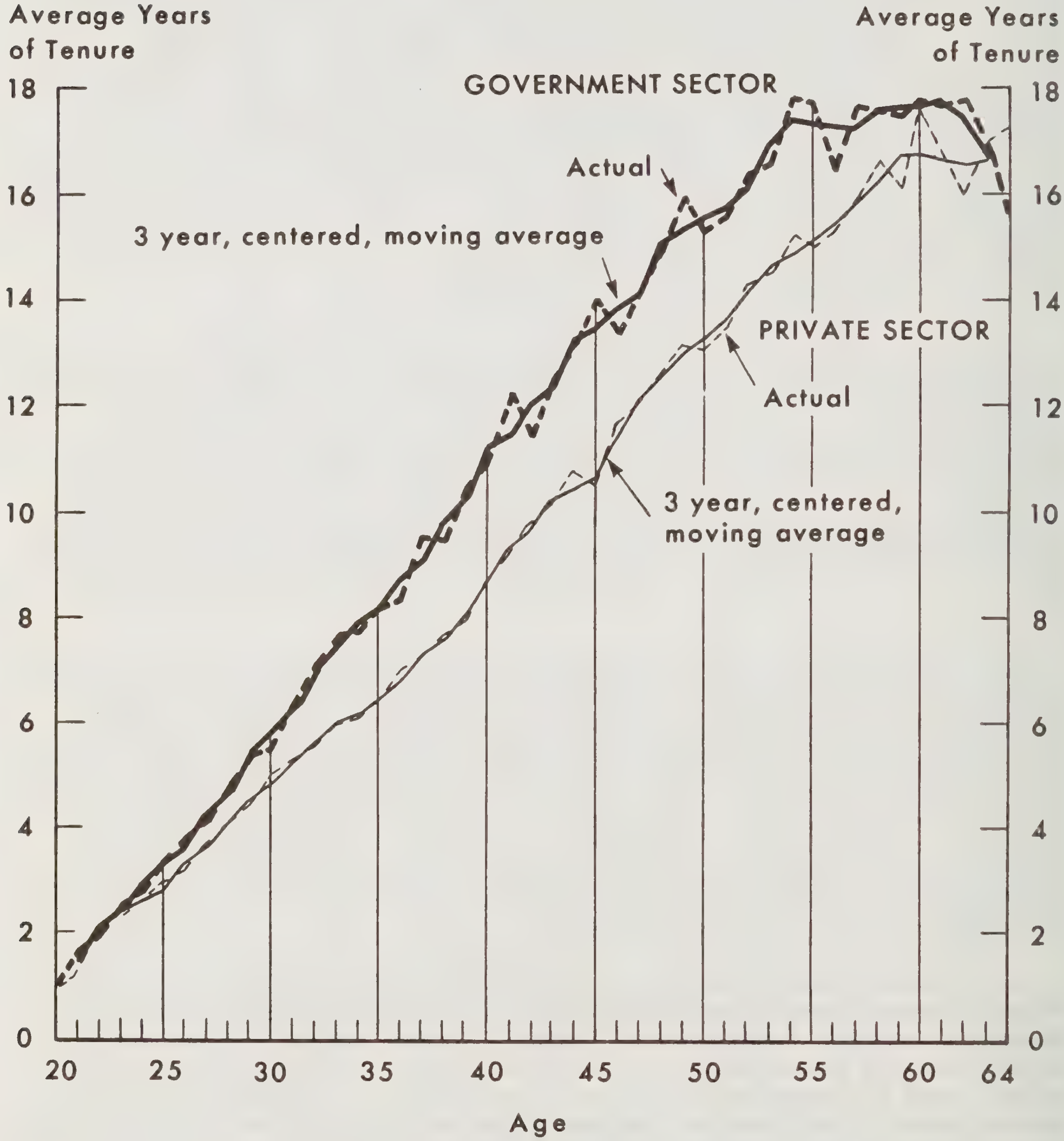
The reasons for restricting the study to males only were (1) time constraints; (2) the smaller size of the female labour force would make the estimates of female labour mobility less reliable; (3) the participation rates of the female labour force are still undergoing structural changes so that an estimate of their current mobility rates is less likely to adequately describe their future behaviour; and (4) preliminary indications were that female mobility was higher than male mobility so that whatever conclusions were to be drawn on the amount of pensionable service expected for males, the results for females would be less.

The amount of mobility found in the labour force was very high. If the amount of measured mobility was assumed to continue for the next 45 years, and if all full-time jobs in the public and private sectors were covered by pension plans with a compulsory 45 and 10 vesting rule, it is estimated that males, aged 20, who entered the labour force today could expect to receive, on average, only about seven years of pensionable service. This is a very low number especially in the light of the assumption that 100% of private and public sector jobs are covered by pension plans. Such results would prove disastrous unless, of course, vesting rules were radically improved.

Tests showed that the amount of mobility implied by the annual transition matrices was substantially higher in the 1976-1977 period than had been the experience in the past. This conclusion was arrived at by creating hypothetical tenure curves over a 45-year period for males, aged 20, entering the labour force today. This hypothetical tenure curve could then be compared to an actual cross-section of average tenure by age, measured from the labour force data.

CHART 1

AVERAGE TENURE, BY AGE, GOVERNMENT AND PRIVATE SECTORS



Source: Print-out Job #6858

Chart 1 depicts the average tenure at various ages in the public and private sectors. Average tenure in the public sector rises linearly from 1 year at age 21 to about 17.5 years at age 55. It drops slightly at ages 56 to 57 due perhaps to early retirement of long-service employees; and again from about age 62. Tenure in the private sector also rises linearly but only reaches its maximum of about 17 years at age 60. The flatter slope of the average tenure curve for private sector employees, at almost all ages, indicates that the underlying mobility rates are higher in the private sector.

The length of tenure measured from the labour force data represents the result of mobility rates which occurred in periods prior to 1976 but which, because of the unavailability of data, could not be measured. The transition matrices or mobility rates discussed earlier represent the average transition process which occurred during the period 1976-1977. Except in a steady-state system, there is no guarantee that the transition process measured today is the same process which occurred in the past to produce the result depicted in Chart 1. Simulating the mobility rates derived from the data generated hypothetical tenure curves in public and private sector employment. These were found to be substantially lower than the actual curves depicted in Chart 1, an indication that mobility rates measured were higher in 1976-1977 than the average rate of past periods.

It was hypothesized that this may have been caused by the high level of unemployment in the period 1976-1977, but a downward reduction in the mobility of short-tenured employees at all ages did not yield the path of tenure shown in Chart 1. An alternative hypothesis was that there had been a structural increase in mobility at all ages and at all lengths of tenure. To account for this, mobility rates at all ages and lengths of tenure were reduced by half. This yielded the desired path of tenure. It was therefore concluded that this adjusted transition matrix closely approximated the mobility process that must have occurred in the past to yield today's observed tenure curve.

Although the evidence suggests that mobility rates have increased, the simulations reported below are based on the adjusted data which assumed that no such structural change had occurred. Therefore, results of these simulations will be conservative, in that the average number and size of pensions will be over-estimated. In a sense, the results represent the upper bound of what the current employer-based pension system will produce even at full maturity.

C. Some Simulation Results

Table 1 summarizes part of the results obtained from the simulation model. It gives the expected years of pensionable service at age 65 which could be expected from the employer-sponsored pension system under a wide combination of vesting rules for a male chosen at random from those entering the labour force at age 20. An alternative way of stating this is that it shows the average results for a large number of individuals at age 65 who had entered the labour force at age 20.

The simulations are based on the following assumptions:

- all full-time employment in both private and government employment is covered by pension plans. Time spent in the three other states (i.e. part-time employment, unemployment/ not in the labour force, and self-employment) are not covered;

- there is no transferability of service from one employer to another and no optional vesting is allowed prior to the compulsory vesting rules stated in the table;

- membership in pension plans is immediate and compulsory and all pension plans have the same compulsory vesting rules; and

- the working life is assumed to start at age 20 and end at age 65.

The simulation predicts that a 45 and 10 rule will produce 21.8 years of pensionable service. (This compares with about seven years using the unadjusted mobility rates, as reported earlier.) Thus the mobility rates in the labour force can have a very large impact on the average size of pensions in retirement. This is especially the case if mobility rates are high and pension vesting rules are stringent. At the other extreme, if vesting is immediate, the amount of mobility will not matter (ignoring for the moment time spent in unemployment and other non-pensionable states) as all service will be vested. This is shown to be 34.6 years in the table (i.e. row age 20 and Column 1 year of service). The table can be read for any other combination of vesting rules based on age and service.

Table 1

Expected Years of Pensionable Service
(males, ages 20 to 64; 100% coverage)

Minimum Age	Minimum Years of Service								
	1	2	3	4	5	8	10	12	15
20	34.6	32.9	31.3	30.3	29.4	26.9	25.4	24.0	22.2
25	33.2	32.0	30.8	30.0	29.3	26.9	25.4	24.0	22.2
30	31.6	30.6	29.6	29.0	28.4	26.6	25.3	24.0	22.2
35	30.0	29.1	28.3	27.8	27.3	25.8	24.7	23.6	22.1
40	27.9	27.2	26.5	26.0	25.5	24.3	23.4	22.6	21.4
45	25.5	24.9	24.3	23.9	23.5	22.5	21.8	21.1	20.1
50	22.8	22.3	21.9	21.6	21.2	20.4	19.8	19.2	18.5

The simulation model designed for this study also yielded a number of other interesting results. For example it estimated the amount of time which a male was expected to spend in various states between the ages of 20 and 65. These were:

- 6.7 years as a full-time government employee;
- 27.8 years as a full-time private sector employee;
- 0.6 years in part-time employment;
- 6.1 years in unemployment or out of the labour force; and
- 3.7 years in self-employment.

The model could also be used to predict the expected number of job changes over the working life of an individual. The model predicted 5.9 job changes. This was relatively close to estimates done in the United States where it was estimated that during the same age intervals (20 to 64) males would change jobs 6.4 times.

D. The Distribution of Pensionable Years of Service

The simulation described above estimated the expected number of years of service under relatively strict assumptions of full coverage and no portability. Also, the distribution around the mean or variance of pension benefits is not given. For example, Table 1 shows that a 45 and 10 vesting rule with 100% pension coverage of service in public and private employment yields an expected 21.8 years of pensionable service. Since this is an average, some individuals could expect more, some less. This distribution of benefits around the mean is an important policy question since we are interested in knowing how many individuals get no vested years of service, how many get 10, 15, ..., 45 years of service. Two widely different distributions can have the same mean, as a simple example will illustrate. Suppose three individuals receive respectively 0, 21.8 and 43.6 years of pensionable service. The average or mean is 21.8 years but the variance or distribution around the mean is very large. Another set of three individuals could have 20, 21.8 and 23.6 years of pensionable service; this yields the same mean - 21.8 - but a much smaller variance. Other things being equal, from a social policy point of view, the second distribution would be preferable to the first. This section reports on simulations which examine the distribution of pensionable service around the mean.

Table 2 sets out the results of the distribution of vested years of service expected from the 45 and 10 rule and 100% pension coverage scenario. Recall that these assumptions yielded an average of 21.8 years of pensionable service. This distribution of vested years of service is compared to the percentage frequency of years worked in government and private employment. An employer-sponsored pension system with immediate and compulsory vesting would yield an identical distribution between years worked and years vested. (An example of this would be a C/QPP where self-employment and part-time work were not covered.) The difference between the two distributions indicates the number of years of service lost because of the less than immediate vesting.

Table 2

Percentage Distribution of Years Worked in Government and Private Employment Relative to Years Vested - Males Ages 20 to 64 (vesting 45 and 10; coverage 100%)

(1) Years Worked or Vested	(2) Percentage Distribution of Years Worked in Public and Private Sectors	(3) Percentage Distribution of Years Vested
0	(1)	14.8
1-5	1.0	0
6-10	1.7	4.0
11-15	2.6	10.4
16-20	4.0	11.8
21-25	6.4	11.4
26-30	11.0	12.1
31-35	16.2	11.2
36-40	25.1	13.2
41-45	32.0	11.2
Total	100.0	100.0

(1)Less than one tenth of 1%.
Note: Numbers may not add due to rounding.

Column 1 groups years worked or vested in five-year groups. Column 2 gives the frequency distribution of years worked in both private and public employment. For example, the last row indicates that 32% of simulated individuals worked between 41 and 45 years as employees in these sectors. However, Column 3 indicates that only 11.2% received between 41 and 45 years of vested service because of job changes prior to vesting. The table indicates that about 14.8% would receive no vested years service, 4% would receive 10 years of pensionable service, the rest (81.2%) would be more or less evenly distributed over the range of 11 to 45 years. Simulations showed that the expected amount of vested benefits and its distribution around the mean was very sensitive to the assumptions on coverage. For example, if the coverage ratio in private employment is reduced to 50% while maintaining the ratio at 100% for public employment and the vesting rule at 45 and 10, the number of individuals with no pensionable service increases dramatically to 46.5% of simulated individuals compared to 14.8% at 100% private sector coverage.

Simulations were also tried where the vesting rule was liberalized in combination with various coverage ratios in private employment. Under the assumption of 50% coverage, liberalizing the pension rules to "35 and 5" still results in about 30% of individuals escaping the pension "net". This is symptomatic of the large amount of mobility for short-tenured employees at all age groups and suggests that the service requirement would have to be substantially reduced and coverage improved if the employer-sponsored system is to provide adequate benefits for a large proportion of the retired population.

A final set of simulations attempted to compare the replacement rates of defined contribution plans relative to defined benefit plans. For the defined contribution plan (a savings plan) it was assumed that 10% of wages was set aside in a fund, accumulating interest at 3% after inflation. The capital accumulated at age 65 was converted into a life pension. The resulting annual income, when compared to wages at age 64, gave the replacement rate. The distribution of simulated individuals by their replacement rates, varying from 0 to 70%, were then calculated. Similarly, three defined benefit schemes with benefit rates of 1, 1.5 and 2% of final salary were simulated and replacement rates calculated. Coverage was assumed to be 100% with full and immediate vesting. The purpose of simulating the savings scheme is because it represents, in a sense, an equitable benchmark with which to compare the defined benefit plans: each individual in the savings plan accumulates, at age 65, exactly the amount that has been credited to his account, plus a real rate of return of 3%. No cross-subsidization can take place among employees. Also, a 10% contribution rate probably reflects the maximum rate of contributions which individuals on average are prepared to pay directly or indirectly towards retirement income. This is also approximately the maximum aggregate saving rate Canada has experienced in recent years.

The result of these simulations showed that only a defined benefit plan with a benefit rate of between 1 and 1 1/4% gives results similar to the benchmark savings scheme; the 1 1/2 and 2% plans yield much richer average pensions. The implication of these results is that a 2% benefit rate for a defined benefit plan, if appropriately and equitably funded, would require a much higher contribution rate than the 10% contribution rate assumed for the savings plan, (probably in the order of 15 to 20% of salaries). These results also imply that a policy of widespread adoption of 2% defined benefit plans, if fully funded, would require contribution rates and therefore aggregate personal saving rates far in excess of current rates. The aggregate saving rate implied (between 15 and 20%) is clearly unsustainable under current circumstances. Since many existing pension plans do have such a benefit rate, the corollary is that they are able to exist only because pension plans have far from universal coverage and relatively stringent vesting rules ensure that a substantial proportion of the population does not receive benefits. In total, aggregate pension contributions in Canada are only around 3 to 4% of total wages and salaries.

E. Implication for Pension Policy

The principal finding of this study is that mobility rates in the labour force in Canada are such that the current regulatory policy of compulsory vesting at age 45 and 10 years of service will not produce any pension benefits for a large proportion of current workers. A further large segment will receive an inadequate level of pension income.

Simulations done for this study show that the problems of designing a pension system which will ensure that pension income in retirement is, on average, adequate and equitably distributed is very complex. Therefore, policies to improve the current system have to be

carefully designed because a solution to one set of problems may have a negative impact on other objectives. For example, the indexing of pensions in retirement to compensate for the effects of inflation may exacerbate the distribution of pension income since indexation would mainly benefit the long-service employees. Thus, the solution to the inflation problem has to be integrated with solutions to improving coverage, vesting and portability of pensions.

Another important conclusion derived from this study is that there are limits to the ability of the economy to finance a "rich" pension system. The widespread adoption of pension plans with benefit formulae that are similar to the so-called "good" plans now available in Canada, if combined with full or close to full and immediate vesting, implies a rate of saving for the economy which is clearly unsustainable under current conditions.

APPENDIX 9

DEMOGRAPHIC ASSUMPTIONS(1)

E. Bower Carty*

The Task Force report contains an analysis of the economic and financial impact of current pension arrangements in Canada and of various alternatives to them. This appendix outlines briefly the demographic assumptions which underlie that analysis.

Experience has demonstrated the difficulties involved in long-range population projections, but trends toward a lower population growth rate and a higher proportion of the elderly over the next half century are clear. For the purposes of the report, a total fertility rate of 1.8 has been assumed. This is 17% below the rate required merely to maintain the population level without net migration. Net annual immigration of 100,000 has been assumed. This fixed figure implies a declining trend relative to the population.

These assumptions were chosen not because they are believed to represent the most likely turn of events, but simply to ensure that the impact of demographic factors on the estimated cost of operating the retirement income system is not under-estimated. Assumptions of higher fertility rates or larger net immigration would moderate the sharp increase in the ratio of those over age 65 to those of labour force age currently anticipated for the first quarter of the next century. With such alternative assumptions, estimated costs for that period would increase less than otherwise.

The population projection based upon these assumptions was one (projection 12) of 25 such projections for the years 1972-2001 published by Statistics Canada in 1974. The technique in such population projections involves a detailed analysis and projection of each of the variables in population change (fertility, migration and mortality) in respect of each province and territory. These regional populations are projected by age and sex, and then are aggregated to obtain the projections for all of Canada.

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* Task Force on Retirement Income Policy. Department of Finance.

(1) This appendix is drawn largely from: Population Projections for Canada and the Provinces, 1972-2001. Statistics Canada (Cat. 91-514);
Technical Report on Population Projections for Canada and the Provinces, 1972-2001. Statistics Canada (Cat. 91-516);
Social Security: National Programs, 1978. Statistics Canada (Cat. 86-201);
Changing Population and the Impact of Government Age-Specific Expenditures, Linda McDonald, Planning Branch, Treasury Board Secretariat, April 1977.

Each of the 25 projections produced was based on various combinations of assumptions concerning fertility and net immigration. The four fertility rates used in the projections range from a low of 1.8 births per woman in her childbearing years to a high of 2.60. Net international migration assumptions (the difference between immigration and emigration) varied from 0 to 140,000 persons per year. The only assumption regarding mortality, based on an examination of past trends in terms of age, sex and cause of death, was that the same percentage change observed for the period from 1955-1959 would continue into the future.

The total fertility rate - the average number of children that women could be expected to have if current birth rates for each age at that time were to persist throughout their lives - has decreased since 1959, when it was 3.935, to 1.84 in 1975, and there are indications of further decreases in 1976 and 1977. It seems unlikely that social attitudes concerning family planning will vary in the foreseeable future to any great extent, thus causing either a further substantial decrease in the fertility rate or an increase resulting in a new baby boom of the size experienced in the fifties and early sixties. There are some demographers, however, who do consider that the low fertility rates observed of late are temporary, simply a result of birth postponements, and that a 'mini baby boom' may indeed occur.(2)

Migration is the most uncertain parameter used in projections, as it depends on various economic, social, demographic and political factors.

Summaries of the population projections underlying the report are provided in Tables 1 and 2. Table 1 shows data for the age groups 0 to 17, 18 to 64, and 65 and over. Similar data for alternative age groups, 0 to 14, 15 to 64, and 65 and over are provided in Table 2.(3)

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(2)Sklar, J. and Berhov, B., The American Birth Rate: Evidence of a Coming Rise, <u>Science</u>, August 1975, p. 691.

(3)In the Task Force report, the work-age population has been used as an indicator of potential labour input. The work-age population has been defined for this purpose to span the ages from 18 through 64 (with occasional alternative data for 18 through 59 to indicate the potential impact of a reduction of the normal age of retirement to 60). Labour force statistics currently cover the population aged 15 and over. Unpublished data indicate that the proportion of the population aged 15 to 17 which is employed full-time is, however, very small, amounting in January 1977 to only 5.6%; the monthly data for 1976, which would reflect summer employment, averaged 10.2%. The corresponding figures for ages 18 and 19 were 38.9% for January 1977 and 45.6% for 1976. In other words, those under age 18 are not an important source of labour supply. Full-time employment from age 65 up is also very small, amounting to less than the full-time employment of those age 18 alone.

Table 1

The Canadian Population and its Age Structure, 1901-1971, and Estimates for 1976-2071

Year	Total Population millions	Percentage Distributions by Age Groups 0-17	18-64	65+
1901	5.4	40.7	54.3	5.0
1911	7.2	38.6	56.7	4.6
1921	8.8	40.0	55.2	4.8
1931	10.4	37.7	56.7	5.6
1941	11.5	33.7	59.6	6.7
1951	14.0	34.9	57.3	7.8
1961	18.2	38.9	53.5	7.6
1971	21.6	35.7	56.2	8.1
1976	22.9	31.6	59.8	8.6
1981	24.4	28.1	62.6	9.3
1986	26.0	26.4	63.7	9.9
1991	27.5	25.9	63.4	10.7
1996	28.7	25.3	63.5	11.2
2001	29.8	24.1	64.5	11.4
2006	30.8	22.8	65.7	11.5
2011	31.7	22.1	65.7	12.3
2016	32.5	21.7	64.5	13.8
2021	33.1	21.5	62.8	15.7
2026	33.6	21.1	61.1	17.8
2031	33.9	20.8	60.0	19.2
2031	33.7	21.0	60.0	19.0
2041	33.9	20.9	60.7	18.4
2051	33.7	21.0	60.5	18.5
2061	33.7	20.9	60.4	18.7
2071	33.7	21.0	60.5	18.5

Sources: 1901-1971 Census;
1976-2031 Statistics Canada population projection based on fertility 1.8 and net annual immigration 100,000;
2031-2071 Statistics Canada population projection based on fertility 1.84 and net annual immigration 100,000.

Table 2

The Canadian Population and its Age Structure, 1901-1971, and Estimates for 1976-2031

Year	Total Population millions	Percentage Distributions by Age Groups 0-14	15-64	65+
1901	5.4	34.6	60.4	5.0
1911	7.2	33.1	62.3	4.6
1921	8.8	34.4	60.8	4.8
1931	10.4	31.6	62.8	5.6
1941	11.5	27.8	65.5	6.7
1951	14.0	29.9	62.1	7.8
1961	18.2	33.9	58.4	7.6
1971	21.6	29.6	62.3	8.1
1976	22.9	25.5	65.9	8.6
1981	24.4	22.6	68.1	9.3
1986	26.0	22.1	68.0	9.9
1991	27.5	22.0	67.3	10.7
1996	28.7	21.1	67.7	11.2
2001	29.8	19.8	68.8	11.4
2006	30.8	18.8	69.7	11.5
2011	31.7	18.3	69.4	12.3
2016	32.5	18.1	68.1	13.8
2021	33.1	17.9	66.4	15.7
2026	33.6	17.5	64.7	17.8
2031	33.9	17.2	63.6	19.2

Sources: 1901-1971 Census;
1976-2031 Statistics Canada population projection based on fertility 1.8 and net annual immigration 100,000.

Several things stand out from the projections:

- work-age population is expected to grow as a proportion of the total population until the first decade of the next century, and then to decline, stabilizing at about the present proportion;

- pre-work-age population is expected to decrease significantly as a proportion of total population (but will remain roughly constant in absolute numbers). Most of this decline is projected to have occurred by the first decade of the next century;

- pre- and post-work-age population together will represent in 2031 about the same proportion of the total population as at present, but over much of this period will be significantly lower than now; and

- post-work-age population will increase both in total numbers and as a proportion of the total population. By 2026 the proportion of the elderly in the total population will be more than double its current level.

The same demographic projections are presented in Table 3 in the form of dependency ratios which express the numbers of those above or below working age as percentages of those of working age.

Dependency ratios are a demographic concept related to social or economic dependency in only the most general sense. For purposes of economic and social analysis, they should be modified by various non-demographic factors. Labour input itself, rather than the size of the work-age population, is relevant for national output. Changing social norms, such as the extent of participation of women in the labour force, or the ages generally accepted as appropriate for entry into, or departure from, the labour force, are important modifiers. Shifts in effective dependency ratios, whether demographic or non-demographic in origin, affect potential output insofar as the numbers of those of working age affect the potential of labour input.

Table 3 illustrates that although the aged-dependency ratio will rise, because of the smaller pre-work-age population projected, the total-dependency ratio will fall significantly, approaching its present level only in 2031. Alternative data illustrate the effect on dependency ratios of a work-age population of 18 through 59, rather than 18 through 64. The aged-dependency ratio in 2031 would then be 45.5% rather than 32.0%.

Table 3

Total- and Aged-Dependency Ratios, 1901-2071

Year	Aged-Dependency Ratio Based on Work-Age Population 18-64	Aged-Dependency Ratio Based on Work-Age Population alternative 18-59	Total-Dependency Ratio Based on Work-Age Population 18-64	Total-Dependency Ratio Based on Work-Age Population alternative 18-59
1901	9.3		84.2	
1911	8.2		76.4	
1921	8.7		81.3	
1931	9.8	15.6	76.4	85.5
1941	11.2	18.2	67.7	78.3
1951	13.5	21.2	74.3	86.2
1961	14.3	21.5	87.1	98.8
1971	14.4	22.2	77.8	90.1
1976	14.4	22.5	67.2	79.2
1981	14.9	22.6	59.7	70.5
1986	15.6	23.8	57.0	68.2
1991	16.9	24.8	57.7	68.5
1996	17.6	25.2	57.4	67.6
2001	17.6	25.2	54.9	64.9
2006	17.5	26.6	52.3	64.0
2011	18.7	29.9	52.3	66.6
2016	21.4	34.6	55.1	72.0
2021	25.1	40.3	59.2	78.6
2026	29.1	44.8	63.7	83.6
2031	32.0	45.5	66.7	83.8
2031	31.7		66.7	
2041	30.3		64.7	
2051	30.6		65.3	
2061	31.0		65.6	
2071	30.6		65.3	

Note: Aged-dependency ratio is (post-work-age population ÷ work-age population) x 100.

Total-dependency ratio is (pre- and post-work-age population ÷ work-age population) x 100.

For Sources see Table 1.

APPENDIX 10

METHODOLOGY AND SOURCES FOR CALCULATING RATES OF RETURN

E. Bower Carty and Irwin Pressman*

The Task Force report makes frequent use of the concept of 'rates of return' on financial assets and on pension fund portfolios. Much of the cost estimation in the report is based upon assumed inflation-adjusted rates of return of 3 1/2%. This rate, to which reference is made again at the end of this appendix, was selected on the basis in part of the work in this appendix. As other examples of the use of rates of return measures, in Chapter IV rates of return realized by trusteed pension funds were shown, and in Chapter IX rates of return data were used in the discussion of the possibility of indexing pensions-in-pay to rates of return and in the discussion of a stabilization facility.

This appendix describes the rationale, methods and sources used for calculating rates of return; it also discusses the rate of return assumptions underlying the cost estimates in the report itself.

Rationale, Methods and Sources

Most available data series on the earnings on financial assets have traditionally reflected the yields on those assets rather than the overall rates of return generated by them. Rates of return data take into account changes in the capital values of financial assets, as well as the income generated by them, whereas yield data are concerned with income streams only. The use in the Task Force report of rates of return, rather than yields, reflects a shift in recent years towards the use of market values, rather than book values, in appraising the investment performance of pension funds.

Annual calculations were made on two bases. One used year-end to year-end data. The other used annual averages from year to year, in consideration of the possibility that year-end rates might not be representative. Both sets of results are covered in this appendix.(1)

For fixed-income securities having more than one year to maturity, the calculations assumed the purchase at the beginning of each year of an hypothetical instrument in the appropriate asset category with a coupon rate corresponding to prevailing yields. The asset was deemed to have been sold at the end of the year at prices corresponding to the yields then prevailing. The general approach may be illustrated by following the year-end rate calculation process for a long-term Government of Canada bond:

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* The authors wish to express their thanks to Ted Requard for his assistance. The appendix draws heavily on earlier work by Nick Rost van Tonningen.

(1) All calculations were done with as many significant digits as the data and the computer permitted. For convenience of publication, the results have been rounded off.

Jan. 1	Purchase 15-year 8.77% bond	\$100.00
Dec. 31	Liquidate 14-year 8.77% bond on a 9.68% yield basis at a price of	93.10
	Capital loss (-)	- 6.90
	Interest income	8.77
	Total nominal return	1.87%

The 8.77% yield shown for January 1 in the illustration is in fact the average yield on Canadas having ten years and over to maturity at the end of 1977, and the 9.68% yield is the corresponding figure for the end of 1978. While the long Canada bond category "ten years and over" frequently will contain bonds with maturities out to 25 years, a 15-year average life to maturity for bonds in this category would not seem inappropriate, in the light of the typical weighting of these bonds throughout the 10 to 25-year maturity range. On this basis, the nominal rate of return on long-term Government of Canada bonds during 1978 is placed at 1.87%.

The alternative calculation, on an annual average rate basis, assumed the purchase of a hypothetical bond bearing a coupon equal to the average of the yields for each of the previous 12 months, and its disposition a year later at a price corresponding to a yield equal to the average over the 12 months in which it was held.

Rates of return on similar bases were derived for six debt instruments having a term of more than one year to maturity:

Three to five-year Government of Canada Bonds
Five-year Guaranteed Investment Certificates
Conventional Mortgages
Long-Term Government of Canada Bonds
10 Provincials (McLeod Young Weir Limited)
10 Industrials (McLeod Young Weir Limited)

For instruments having shorter terms - three-month Treasury Bills and 90-day Finance Company Paper - rates of return were deemed to correspond to yields. Given their limited life span, even substantial changes in interest rates give rise to relatively minor changes in the capital values of such money market instruments. In addition, their short life span means that the funds involved can be 'rolled over' at frequent intervals. This provides investors with frequent opportunities to participate in whatever adjustment in the interest rate structure may occur from time to time. The rate of return on money market instruments was therefore calculated by compounding the quarterly averages of yields.

For equities, dividend income was combined with the capital value change to arrive at a nominal rate of return.

To move from nominal rates of return to inflation-adjusted rates, an indicator of the rate of inflation was required. For this, the Consumer Price Index (CPI) was used. Inflation-adjusted rates of return were derived by deflating the nominal results by the percentage year-end to year-end change in the CPI in the case of year-end measures, and by

the percentage change between the monthly average CPI for the previous and current years in the case of the annual average measures, as described in greater detail in the annexes. The 1978 results for long-term Canadas on a year-end basis, used in the earlier illustration, were converted to an inflation-adjusted basis as follows:

Consumer Price Index	December 1977	167.2
	December 1978	181.3
Ratio 181.3/167.2		1.0843
Nominal rate of return shown earlier		1.87%
Inflation-adjusted rate of return		

$$\frac{100 + 1.87}{1.0843} - 100 = -6.05\%$$

This describes in general terms the methodology employed. More detailed descriptions are given in the following annexes:

A. Three-month Treasury Bills
B. 90-day Finance Company Paper
C. Three to five-year Government of Canada Bonds
D. Five-year Guaranteed Investment Certificates
E. Conventional Mortgages
F. Long-term Government of Canada Bonds
G. 10 Provincials (McLeod Young Weir Limited)
10 Industrials (McLeod Young Weir Limited)
H. Stocks
I. United States Treasury Bills, Long Treasury Bonds, Long Corporate Bonds, and Stocks

Rate of Return Assumptions in Task Force Report

The results are presented in the tables which follow. Table 1 shows annual average inflation-adjusted rates of return on nine types of financial assets in Canada for the years 1952 through 1978. Table 2 shows year-end inflation-adjusted rates of return for the same types of financial assets and time span. Table 3 shows inflation-adjusted rates of return, on both the annual average and year-end bases, for three-month Treasury Bills, long Canadas, and equities over considerably longer time perspectives. These instruments were judged to be the most representative of those for which data exist back to World War I. (The nominal rates of return underlying Tables 1, 2 and 3 are provided in Tables 5, 6 and 7 respectively.)

Table 4 provides some data in respect of United States experience for the period 1926 through 1974. A comparison of the similar Canadian and United States series may be of interest to some readers. For the longest available time periods covered by the calculations of inflation-adjusted annual rates of return made in the United States source and made for this appendix, the data are as follows:

Investment	Period	United States	Canada
Treasury Bills	1934-1974	- 1.1%	- 0.8%
Long Government bonds	1926-1974	1.0	1.4
Long Corporate bonds	1949-1974	- 0.5	- 0.2
Stocks	1926-1974	6.1	5.2

The analysis of rates of return in the Task Force report was generally confined to the 1952-1978 period. This was done because prior to the mid-fifties, Canadian financial markets were relatively less developed. In addition, government security prices were influenced by measures related to government wartime policy objectives with respect to interest rates.

The series on either an annual average or a year-end basis may be used. Over time they exhibit similar characteristics, although a comparison will indicate that substantial differences in annual results may occur depending on the base period chosen.

It must be emphasized that the rates for different instruments are not strictly comparable due to variations in the detailed methodology as described in the annexes. These variations arise for the most part from data limitations and the specific uses for which the series were prepared.

For the purpose of developing estimates of pension costs, the Task Force generally used a long-run inflation-adjusted rate of return of 3 1/2%; 2% was used for some alternative estimates. The selection of each of these rates was predicated on the assumption that it was appropriate to look at the longest periods of time for which representative data were generally available, as an indication of the levels which might be expected over the very long run in the future. The 2% rate of return is predicated on a portfolio invested in long-term Government of Canada debt and is roughly the level achieved over the period 1920 to 1978. The 3 1/2% rate is predicated on a mixed portfolio of bonds, stocks and mortgages over roughly the same period.(2) Had a shorter horizon, of perhaps 25 years been used, lower rates would have been selected in each case.

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(2)A mixed portfolio comprising Canadian bonds, Canadian stocks, and mortgages in the proportions held by private sector trusteed pension funds at the end of 1976 was hypothesized. The inflation-adjusted rates of return applied to the bond portion of this portfolio was the long-run rate for long-term Government of Canada bonds shown in Table 3, increased by two-thirds (39 basis points) of the difference (58 basis points) between the rates over the period 1952 through 1978 shown in Table 1 for industrial bonds (56 basis points) relative to long term Canadas (-2 basis points). This rough adjustment was made in recognition of the prominence of the higher yielding bonds in the portfolios. The long-run rate used for the stock portion of the portfolios was as shown in Table 3. The differential for mortgages over the rates for long-term Canadas for 1952 through 1978 shown in Table 1 was added to the long-term Canada rate for 1920 through 1978 shown in Table 3 to derive a long-run rate for mortgages. The weighted long-run rate of return for the portfolio was just under 4%. The Task Force chose to use 3 1/2% for purposes of the cost and other analyses.

Table 1

Inflation-Adjusted Rates of Return on Financial Assets in Canada 1952-1978

(on annual average rate basis)

Year	3-Month Treasury Bills	90-Day Finance Paper	3-5 Year Government of Canada Bonds	5-Year Guaranteed Investment Certificates	Conventional Mortgages	Long-Term Government of Canada Bonds	McLeod Young Weir 10 Pro-vincials	McLeod Young Weir 10 Indus-trials	Stocks
1952	-1.30	-0.43	-1.54	0.53	1.92	-2.72	-3.74	-2.66	4.87
1953	2.59	3.50	3.54	3.85	5.80	2.90	4.74	2.55	-1.93
1954	0.78	1.67	5.00	3.98	4.72	8.94	12.40	8.97	16.73
1955	1.47	2.37	2.17	3.49	5.61	3.46	4.32	5.39	32.02
1956	1.45	2.27	-1.39	1.37	3.21	-3.62	-8.76	-5.20	17.18
1957	0.64	2.14	-1.58	-0.18	1.37	-4.54	-7.51	-7.19	-5.78
1958	-0.35	0.55	4.90	1.93	3.74	1.46	5.17	7.04	-5.78
1959	3.76	4.15	-1.65	2.37	4.82	-6.47	-6.56	-3.30	15.58
1960	1.91	2.71	4.73	3.96	4.74	2.64	4.08	3.35	-6.56
1961	1.95	2.51	4.01	4.93	6.07	5.65	6.65	7.36	27.90
1962	2.88	3.22	2.52	3.27	5.29	3.14	4.08	4.61	-1.32
1963	1.83	2.28	3.13	3.47	4.64	3.56	4.47	4.49	9.19
1964	1.97	2.43	1.99	3.08	4.61	2.31	2.48	2.08	19.34
1965	1.54	2.59	1.73	2.26	3.80	2.42	2.31	0.95	10.87
1966	1.30	2.58	-0.59	0.74	1.57	-3.02	-5.61	-6.68	-5.23
1967	1.11	2.32	1.67	1.90	2.74	-0.20	-1.64	-3.10	5.76
1968	2.24	2.80	-1.18	0.98	1.62	-5.19	-6.08	-4.90	4.41
1969	2.76	3.42	-0.41	0.63	2.55	-4.71	-4.30	-4.00	9.67
1970	2.67	4.04	5.59	3.66	4.74	1.42	-0.70	1.53	-11.71
1971	0.75	1.70	8.27	6.94	8.68	13.25	15.57	13.80	6.66
1972	-1.11	0.41	-1.07	2.99	4.34	-0.29	2.18	3.82	15.16
1973	-1.89	0.05	-3.06	-0.98	0.39	-2.97	-1.50	-0.86	1.96
1974	-2.53	0.05	-6.19	-4.80	-4.20	-12.56	-14.12	-14.89	-21.50
1975	-2.90	-2.38	-1.36	-0.76	-0.37	-2.66	-2.78	-4.91	-7.21
1976	1.54	1.85	-1.38	1.02	2.60	0.40	2.89	5.17	0.56
1977	-0.42	-0.28	1.55	3.86	5.39	4.62	6.67	8.45	-5.36
1978	0.04	0.20	-3.88	-0.49	0.48	-4.25	-2.15	-1.66	9.64
Compound Annual Rate of Return	0.90	1.79	0.89	1.97	3.33	-0.02	0.26	0.56	4.32

Table 2

Inflation-Adjusted Rates of Return on Financial Assets in Canada 1952-1978

(on a year end rate basis)

Year	3-Month Treasury Bills	90-Day Finance Paper	3-5 Year Government of Canada Bonds	5-Year Guaranteed Investment Certificates	Conventional Mortgages	Long-Term Government of Canada Bonds	McLeod Young Weir 10 Pro-vincials	McLeod Young Weir 10 Indus-trials	Stocks
1952	3.03	3.93	3.64	5.38	7.19	4.16	7.02	6.59	1.49
1953	1.72	2.61	3.04	2.92	4.74	3.61	5.20	3.79	-4.26
1954	0.83	1.72	6.22	4.26	5.16	8.37	13.60	10.17	38.93
1955	1.33	2.22	-0.69	3.07	5.28	-0.15	-3.39	1.74	23.19
1956	-0.14	0.67	-2.72	-0.29	1.02	-5.60	-13.55	-11.39	8.43
1957	1.63	3.15	4.12	0.83	3.38	3.79	8.12	5.15	-22.33
1958	-0.24	0.66	0.01	2.21	4.10	-7.06	-4.31	0.36	28.30
1959	3.48	3.86	0.95	1.70	4.05	-4.84	-7.05	-6.29	3.01
1960	1.87	2.67	4.65	5.03	5.79	5.40	9.72	10.79	0.29
1961	2.70	3.27	7.07	5.21	6.36	8.98	9.32	8.78	32.33
1962	2.48	2.82	1.37	2.81	4.83	1.62	2.78	3.10	-8.73
1963	1.75	2.20	2.00	3.37	4.59	2.73	2.51	3.37	13.45
1964	1.84	2.30	2.47	2.97	4.49	4.34	4.92	2.48	22.90
1965	1.12	2.15	0.08	1.21	2.79	-1.43	-2.95	-3.81	3.51
1966	1.49	2.77	0.70	1.89	2.27	-1.52	-5.28	-5.54	-10.31
1967	0.56	1.77	-0.94	1.26	2.19	-5.24	-4.07	-4.69	13.29
1968	2.24	2.80	0.82	1.49	2.78	-3.74	-2.82	-2.05	17.54
1969	2.69	3.35	-0.70	0.10	1.47	-5.71	-7.62	-5.95	-5.31
1970	4.60	6.00	14.47	7.68	9.01	18.44	16.43	11.86	-4.99
1971	-1.36	-0.43	1.23	4.89	6.22	5.57	7.75	8.96	2.90
1972	-1.41	0.11	-2.34	1.21	3.14	-3.27	1.05	3.82	21.14
1973	-3.25	-1.34	-5.90	-3.14	-1.68	-6.34	-7.78	-6.42	-8.79
1974	-3.91	-1.36	-3.94	-5.67	-5.50	-11.82	-13.91	-16.91	-34.79
1975	-1.72	-1.20	-5.71	0.51	1.72	-5.69	-2.32	-1.32	9.31
1976	3.16	3.47	4.47	4.71	6.29	11.28	13.73	14.87	4.83
1977	-1.79	-1.65	-3.03	1.43	2.69	-3.12	-0.89	1.25	0.36
1978	0.49	0.64	-4.57	-1.54	-0.65	-6.05	-4.40	-3.61	19.10
Compound Annual Rate of Return	0.91	1.80	0.90	2.02	3.43	0.03	0.49	0.81	4.78

Table 3

Inflation-Adjusted Rates of Return on Financial Assets in Canada, 1915-1978

	Annual Average Rate Basis			Year-End Rate Basis		
Year	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks
1915	-	-	-5.25	-	-	-
1916	-	-	7.93	-	-	-6.76
1917	-	-	-16.62	-	-	-20.58
1918	-	-	-11.43	-	-	-0.84
1919	-	-	6.15	-	-	5.32
1920	-	-13.67	-8.65	-	-9.25	-14.19
1921	-	21.64	2.88	-	33.91	16.61
1922	-	21.83	22.68	-	12.37	23.40
1923	-	8.25	12.87	-	5.94	6.09
1924	-	7.94	9.03	-	9.66	12.45
1925	-	5.45	17.22	-	2.25	23.73
1926	-	3.81	29.10	-	6.70	24.08
1927	-	9.09	30.18	-	10.65	44.29
1928	-	5.19	32.68	-	0.33	31.13
1929	-	-0.78	22.17	-	0.31	-12.53
1930	-	7.66	-24.14	-	15.32	-26.25
1931	-	17.30	-26.14	-	7.14	-26.24
1932	-	9.84	-23.88	-	20.63	-9.00
1933	-	15.92	33.79	-	9.17	52.56
1934	1.16	9.76	27.23	1.38	16.05	17.95
1935	0.84	7.44	10.24	-0.45	-0.83	26.36
1936	-0.93	8.63	31.50	-0.55	10.43	22.36
1937	-2.40	-2.46	6.77	-2.81	-3.59	-18.69
1938	-0.47	2.93	-14.44	2.25	6.98	9.95
1939	1.48	3.18	2.15	-1.98	-4.75	-3.26

Table 3 (Cont'd)

Year	Annual Average Rate Basis			Year-End Rate Basis		
	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks
1940	3.23	-2.24	-13.94	-3.17	3.75	-22.46
1941	-4.96	-0.42	-12.49	-6.16	-3.27	-5.60
1942	-4.11	-1.28	-3.51	-2.27	0.18	9.29
1943	-1.25	1.88	33.48	-0.68	2.55	17.64
1944	-0.10	2.62	4.68	1.32	4.07	13.49
1945	-0.15	3.22	22.44	-1.01	3.39	32.60
1946	-2.90	3.16	15.83	-5.25	-0.41	-7.47
1947	-8.27	-5.82	-12.83	-12.28	-9.96	-9.00
1948	-12.06	-13.73	-2.94	-7.61	-9.52	5.42
1949	-2.59	0.37	-0.46	-0.72	3.29	6.13
1950	-2.31	0.12	22.21	-5.15	-5.39	22.70
1951	-8.80	-10.73	20.09	-9.07	-11.83	14.09
1952	-1.30	-2.72	4.87	3.03	4.16	1.49
1953	2.59	2.90	-1.93	1.72	3.61	-4.26
1954	0.78	8.94	16.73	0.83	8.37	38.93
1955	1.47	3.46	32.02	1.33	-0.15	23.19
1956	1.45	-3.62	17.18	-0.14	-5.60	8.43
1957	0.64	-4.54	-5.78	1.63	3.79	-22.33
1958	-0.35	1.46	-5.78	-0.24	-7.06	28.30
1959	3.76	-6.47	15.58	3.48	-4.84	3.01
1960	1.91	2.64	-6.56	1.87	5.40	0.29
1961	1.95	5.65	27.90	2.70	8.98	32.33
1962	2.88	3.14	-1.32	2.48	1.62	-8.73
1963	1.83	3.56	9.19	1.75	2.73	13.45
1964	1.97	2.31	19.34	1.84	4.34	22.90
1965	1.54	2.42	10.87	1.12	-1.43	3.51
1966	1.30	-3.02	-5.23	1.49	-1.52	-10.31
1967	1.11	-0.20	5.76	0.56	-5.24	13.29
1968	2.24	-5.19	4.41	2.24	-3.74	17.54
1969	2.76	-4.71	9.67	2.69	-5.71	-5.31

Table 3 (Cont'd)

Year	Annual Average Rate Basis			Year-End Rate Basis		
	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks
1970	2.67	1.42	-11.71	4.60	18.44	-4.99
1971	0.75	13.25	6.66	-1.36	5.57	2.90
1972	-1.11	-0.29	15.16	-1.41	-3.27	21.14
1973	-1.89	-2.97	1.96	-3.25	-6.34	-8.79
1974	-2.53	-12.56	-21.50	-3.91	-11.82	-34.79
1975	-2.90	-2.66	-7.21	-1.72	-5.69	9.31
1976	1.54	0.40	0.56	3.16	11.28	4.83
1977	-0.42	4.62	-5.36	-1.79	-3.12	0.36
1978	0.04	-4.25	9.64	0.49	-6.05	19.10
Compound Annual Rate for Period Shown	-0.64	1.93	4.74	-0.71	1.92	5.08

Note:

The principal factor in the relatively large difference shown between the compound annual inflation-adjusted returns on stocks on annual average and year-end bases is the difference in periods covered.

	Annual Average Basis	Year-End Basis
1915-1978	4.74	-
1916-1978	4.91	5.08

The remaining difference is partly accounted for by monthly compounding of dividend yields in the year-end rate calculation. (A return of 5% compounded monthly is equivalent on an annual basis to 5.12%).

Table 4

Inflation Adjusted Rates of Return on Financial Assets in the United States 1926-1974
(on a year end rate basis)

Year	Treasury Bills	Long Treasury Bonds	Long Corporate Bonds	Stocks
1926	4.7	9.4	9.0	13.3
1927	5.3	11.2	9.7	40.4
1928	5.0	1.1	3.8	45.0
1929	4.7	3.2	3.1	-8.6
1930	8.8	11.4	14.9	-20.1
1931	11.3	9.4	8.5	-37.4
1932	12.6	30.2	23.5	2.3
1933	-0.2	-0.6	9.8	53.2
1934	-1.8	7.8	11.6	-3.4
1935	-2.8	2.0	6.4	43.4
1936	-1.0	6.2	5.5	32.3
1937	-2.7	-2.8	-0.3	-37.0
1938	2.9	8.5	9.2	34.9
1939	0.5	6.5	4.5	0.1
1940	-1.0	5.1	2.4	-10.7
1941	-8.8	-8.0	-6.3	-19.4
1942	-8.3	-5.5	-6.1	10.1
1943	-2.7	-1.1	-0.3	22.0
1944	-1.7	0.7	2.6	17.3
1945	-1.9	8.3	1.8	33.4
1946	-15.1	-15.5	-13.9	-22.3
1947	-7.8	-10.7	-10.4	-2.9
1948	-1.8	0.7	1.4	2.7
1949	2.6	8.4	5.2	21.0
1950	-4.4	-5.4	-3.5	24.6
1951	-4.2	-9.3	-8.1	17.1
1952	0.7	0.3	2.6	17.3
1953	1.2	3.0	2.8	-1.6
1954	1.3	7.7	5.9	53.3
1955	1.2	-1.7	0.1	31.0
1956	-0.4	-8.2	-9.4	3.6
1957	0.1	4.3	5.4	-13.4
1958	-0.2	-7.7	-3.9	40.9
1959	1.5	-3.7	-2.4	10.3
1960	1.1	12.1	7.5	-1.0
1961	1.4	0.3	4.1	26.0
1962	1.5	5.6	6.6	-9.8
1963	1.4	-0.5	0.5	20.8
1964	2.3	2.3	3.5	15.1
1965	2.0	-1.2	-2.4	10.3
1966	1.4	0.3	-3.1	-13.0
1967	1.1	-11.9	-7.8	20.3
1968	0.4	-4.8	-2.1	6.1
1969	0.5	-10.5	-13.4	-13.7
1970	0.9	6.2	12.2	-1.5
1971	1.0	9.5	7.4	10.6
1972	0.4	2.2	3.7	15.0
1973	-1.7	-3.0	-7.0	-21.6
1974	-3.1	-6.4	-13.1	-34.1
Compound Annual Rate of Return	0.1	1.0	1.4	6.1

Source: R.G. Ibbotson and R.A. Sinquefield: "Stocks, Bonds, Bills and Inflation". Year by Year Historical Returns 1926-1974, Journal of Business, Volume 49, Number 1, January 1976. (Data for stocks for 1939, 1940, 1946 and 1947 have been recalculated.)

Table 5

Nominal Rates of Return on Financial Assets in Canada 1952-1978

(on annual average rate basis)

Year	3-Month Treasury Bills	90-Day Finance Paper	3-5 Year Government of Canada Bonds	5-Year Guaranteed Investment Certificates	Conventional Mortgages	Long-Term Government of Canada Bonds	McLeod Young Weir 10 Provincials	McLeod Young Weir 10 Industrials	Stocks
1952	1.07	1.96	0.82	2.94	4.37	-0.39	-1.43	-0.33	7.39
1953	1.72	2.61	2.66	2.97	4.90	2.03	3.85	1.68	-2.76
1954	1.43	2.33	5.68	4.65	5.39	9.65	13.13	9.68	17.49
1955	1.63	2.52	2.32	3.64	5.76	3.62	4.48	5.55	32.21
1956	2.96	3.79	0.07	2.87	4.73	-2.19	-7.40	-3.79	18.91
1957	3.81	5.36	1.52	2.96	4.56	-1.53	-4.60	-4.26	-2.81
1958	2.27	3.20	7.66	4.61	6.46	4.13	7.94	9.85	-3.30
1959	4.90	5.28	-0.58	3.49	5.96	-5.45	-5.54	-2.24	16.85
1960	3.24	4.06	6.10	5.32	6.11	3.98	5.44	4.70	-5.34
1961	2.84	3.41	4.92	5.85	7.00	6.57	7.58	8.30	29.02
1962	4.11	4.46	3.75	4.51	6.55	4.38	5.33	5.86	-0.13
1963	3.61	4.07	4.93	5.28	6.47	5.37	6.29	6.31	11.10
1964	3.80	4.27	3.81	4.93	6.48	4.14	4.32	3.91	21.48
1965	4.04	5.11	4.23	4.78	6.36	4.94	4.83	3.43	13.59
1966	5.09	6.42	3.13	4.51	5.36	0.60	-2.08	-3.20	-1.69
1967	4.72	5.98	5.30	5.54	6.41	3.37	1.87	0.37	9.54
1968	6.42	7.00	2.86	5.11	5.77	-1.32	-2.24	-1.02	8.68
1969	7.39	8.08	4.08	5.16	7.17	-0.41	0.02	0.32	14.62
1970	6.13	7.55	9.15	7.15	8.26	4.83	2.64	4.95	-8.74
1971	3.61	4.59	11.34	9.97	11.76	16.46	18.84	17.03	9.68
1972	3.61	5.20	3.66	7.91	9.32	4.47	7.06	8.78	20.66
1973	5.58	7.66	4.32	6.56	8.03	4.42	6.00	6.69	9.72
1974	8.06	10.93	4.00	5.54	6.21	-3.06	-4.79	-5.64	-12.98
1975	7.60	8.17	9.30	9.97	10.40	7.87	7.74	5.37	2.82
1976	9.17	9.49	6.03	8.61	10.31	7.94	10.61	13.07	8.11
1977	7.54	7.69	9.66	12.16	13.81	12.99	15.19	17.12	2.21
1978	8.96	9.13	4.68	8.37	9.44	4.28	6.57	7.10	19.42
Compound Annual Rate of Return	4.62	5.54	4.61	5.73	7.14	3.66	3.95	4.26	8.16

Table 6
Nominal Rates of Return on Financial Assets in Canada 1952-1978
(on a year end rate basis)

Year	3-Month Treasury Bills	90 Day Finance Paper	3-5 Year Government of Canada Bonds	5-Year Guaranteed Investment Certificates	Conventional Mortgages	Long-Term Government of Canada Bonds	McLeod Young Weir 10 Provincials	McLeod Young Weir 10 Industrials	Stocks
1952	1.07	1.96	1.67	3.38	5.16	2.18	4.99	4.57	-0.44
1953	1.72	2.61	3.04	2.92	4.74	3.61	5.20	3.79	-4.26
1954	1.43	2.33	6.85	4.88	5.79	9.02	14.28	10.83	39.75
1955	1.63	2.52	-0.40	3.38	5.59	0.14	-3.10	2.04	23.55
1956	2.96	3.79	0.29	2.80	4.15	-2.68	-10.88	-8.65	11.79
1957	3.81	5.36	6.35	3.00	5.60	6.02	10.44	7.40	-20.66
1958	2.27	3.20	2.53	4.79	6.73	-4.71	-1.90	2.89	31.53
1959	4.90	5.28	2.33	3.09	5.47	-3.54	-5.78	-5.01	4.42
1960	3.24	4.06	6.06	6.44	7.21	6.82	11.19	12.29	1.64
1961	2.84	3.41	7.21	5.35	6.50	9.12	9.46	8.93	32.51
1962	4.11	4.46	2.99	4.44	6.50	3.24	4.42	4.74	-7.27
1963	3.61	4.07	3.86	5.26	6.50	4.61	4.39	5.26	15.53
1964	3.80	4.27	4.44	4.96	6.50	6.35	6.94	4.45	25.26
1965	4.04	5.11	2.98	4.14	5.76	1.43	-0.14	-1.03	6.50
1966	5.09	6.42	4.28	5.51	5.90	1.97	-1.92	-2.18	-7.12
1967	4.72	5.98	3.16	5.45	6.42	-1.32	-0.10	-0.75	17.98
1968	6.42	7.00	4.94	5.63	6.97	0.19	1.15	1.95	22.35
1969	7.39	8.08	3.85	4.68	6.12	-1.40	-3.39	-1.64	-0.97
1970	6.13	7.55	16.14	9.25	10.61	20.17	18.13	13.49	-3.60
1971	3.61	4.59	6.33	10.17	11.57	10.89	13.18	14.45	8.08
1972	3.61	5.20	2.63	6.36	8.38	1.65	6.19	9.10	27.30
1973	5.58	7.66	2.68	5.70	7.29	2.20	0.63	2.11	-0.47
1974	8.06	10.93	8.02	6.08	6.27	-0.83	-3.18	-6.56	-26.67
1975	7.60	8.17	3.24	10.04	11.36	3.25	6.94	8.04	19.68
1976	9.17	9.49	10.55	10.81	12.48	17.76	20.35	21.55	10.93
1977	7.54	7.69	6.18	11.07	12.44	6.08	8.52	10.86	9.89
1978	8.96	9.13	3.48	6.76	7.73	1.87	3.66	4.51	29.15
Compound Annual Rate of Return	4.62	5.54	4.61	5.76	7.23	3.70	4.18	4.51	8.63

Table 7

Nominal Rates of Return on Financial Assets in Canada, 1915-1978

Year	Annual Average Rate Basis			Year-End Rate Basis		
	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks
1915	-	-	-3.36	-	-	-
1916	-	-	16.98	-	-	6.56
1917	-	-	-1.32	-	-	-7.89
1918	-	-	0.20	-	-	11.83
1919	-	-	16.62	-	-	14.69
1920	-	0.02	5.84	-	-1.29	-6.66
1921	-	7.04	-9.46	-	13.06	-1.55
1922	-	11.57	12.35	-	8.88	19.56
1923	-	8.64	13.28	-	7.40	7.55
1924	-	5.97	7.04	-	7.42	10.16
1925	-	6.43	18.31	-	5.08	27.16
1926	-	4.88	27.40	-	5.26	22.41
1927	-	7.29	28.04	-	9.39	42.65
1928	-	5.64	33.24	-	1.02	32.04
1929	-	0.32	23.53	-	2.60	-10.53
1930	-	7.01	-24.60	-	8.62	-30.54
1931	-	5.79	-33.39	-	-3.80	-33.77
1932	-	-0.25	-30.88	-	11.37	-15.98
1933	-	10.49	27.52	-	6.98	49.50
1934	2.57	11.29	29.01	2.57	17.41	19.33
1935	1.57	8.22	11.04	1.57	1.18	28.92
1936	0.85	10.59	33.86	0.85	12.00	24.09
1937	0.72	0.66	10.18	0.72	-0.09	-15.73
1938	0.60	4.04	-13.53	0.60	5.25	8.17
1939	0.71	2.39	1.36	0.71	-2.14	-0.61

Table 7 (Cont'd)

Year	Annual Average Rate Basis: 3-Month Treasury Bills	Annual Average Rate Basis: Long Government of Canada Bonds	Annual Average Rate Basis: Stocks	Year-End Rate Basis: 3-Month Treasury Bills	Year-End Rate Basis: Long Government of Canada Bonds	Year-End Rate Basis: Stocks
1940	0.71	1.73	-10.43	0.71	7.90	-19.36
1941	0.58	5.39	-7.39	0.58	3.68	1.17
1942	0.54	3.51	1.17	0.54	3.06	12.43
1943	0.48	3.67	35.82	0.48	3.74	19.01
1944	0.39	3.12	5.18	0.39	3.11	12.45
1945	0.36	3.76	23.08	0.36	4.83	34.45
1946	0.39	6.65	19.75	0.39	5.51	-1.96
1947	0.41	3.09	-4.58	0.41	3.07	4.17
1948	0.41	-1.49	10.82	0.41	-1.66	14.57
1949	0.49	3.54	2.68	0.49	4.54	7.42
1950	0.55	3.05	25.79	0.55	0.29	30.06
1951	0.79	-1.34	32.73	0.79	-2.27	26.45
1952	1.07	-0.39	7.39	1.07	2.18	-0.44
1953	1.72	2.03	-2.76	1.72	3.61	-4.26
1954	1.43	9.65	17.49	1.43	9.02	39.75
1955	1.63	3.62	32.21	1.63	0.14	23.55
1956	2.96	-2.19	18.91	2.96	-2.68	11.79
1957	3.81	-1.53	-2.81	3.81	6.02	-20.66
1958	2.27	4.13	-3.30	2.27	-4.71	31.53
1959	4.90	-5.45	16.85	4.90	-3.54	4.42
1960	3.24	3.98	-5.34	3.24	6.82	1.64
1961	2.84	6.57	29.02	2.84	9.12	32.51
1962	4.11	4.38	-0.13	4.11	3.24	-7.27
1963	3.61	5.37	11.10	3.61	4.61	15.53
1964	3.80	4.14	21.48	3.80	6.35	25.26
1965	4.04	4.94	13.59	4.04	1.43	6.50
1966	5.09	0.60	-1.69	5.09	1.97	-7.12
1967	4.72	3.37	9.54	4.72	-1.32	17.98
1968	6.42	-1.32	8.68	6.42	0.19	22.35
1969	7.39	-0.41	14.62	7.39	-1.40	-0.97

Table 7 (Cont'd)

	Annual Average Rate Basis			Year-End Rate Basis		
Year	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks	3-Month Treasury Bills	Long Government of Canada Bonds	Stocks
1970	6.13	4.83	-8.74	6.13	20.17	-3.60
1971	3.61	16.46	9.68	3.61	10.89	8.08
1972	3.61	4.47	20.66	3.61	1.65	27.30
1973	5.58	4.42	9.72	5.58	2.20	-0.47
1974	8.06	-3.06	-12.98	8.06	-0.83	-26.67
1975	7.60	7.87	2.82	7.60	3.25	19.68
1976	9.17	7.94	8.11	9.17	17.76	10.93
1977	7.54	12.99	2.21	7.54	6.08	9.89
1978	8.96	4.28	19.42	8.96	1.87	29.15
Compound Annual Rate for Period Shown	3.04	4.23	7.74	3.04	4.20	8.12

ANNEX A

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR THREE-MONTH GOVERNMENT OF CANADA TREASURY BILLS

Data Source:

- Three-month Government of Canada Treasury Bill yields are as compiled and published by the Bank of Canada - the average of rates at the Thursday tender following the last Wednesday of each month. They were obtained from the Statistics Canada machine-readable Canadian Socio-Economic Information Management system, CANSIM (registered TM) series B14007.

- The Consumer Price Index (CPI) which was used as the measure of inflation is compiled and published monthly by Statistics Canada and was obtained from CANSIM (series D484000).

Method - Annual Average Rates

- Purchase at the beginning of the year of a 3-month Government of Canada Treasury Bill at the average of rates at the three Thursday tenders following the last Wednesday of each month in the first quarter. Reinvestment at correspondingly calculated yields for each subsequent quarter of the year.

- Nominal rate of return is the earned discount expressed as a percentage of the amount invested.

- Inflation-adjusted rate of return represents the sum of \$100 plus the nominal rate of return, deflated by the percentage increase of the average of the CPI during the year in which the instruments are held over the corresponding average for the previous year, less \$100.

Example:

Treasury Bill Yield Averages	IQ 78	7.387%
	IIQ 78	8.216
	IIIQ 78	8.876
	IVQ 78	10.223

CPI Average 1977 160.82 1978 175.15

Nominal rate of return, 1978:

$$100\left(\left(1+\frac{0.07387}{4}\right)\left(1+\frac{0.08216}{4}\right)\left(1+\frac{0.08876}{4}\right)\left(1+\frac{0.10223}{4}\right)\right)-100$$

$$= 8.96\%$$

Inflation-adjusted rate of return, 1978:

$$\left((100 + 8.96) \times \frac{160.82}{175.15}\right) - 100 = 0.04\%$$

Method - Year End Rates

As above, except

. CPI data used are for December of previous and current years.

Example: Nominal rate of return, 1978 (as above) 8.96%
CPI December: 1977 167.2 1978 181.3

Inflation adjusted rate of return, 1978

$$((100 + 8.96) \times \frac{167.2}{181.3}) - 100 = 0.49\%$$

Notes:

1. The Treasury Bill yields are as conventionally quoted in the Canadian market.

2. The recorded series goes back to 1934, but in both 1934 and 1935 there were months in which no Treasury Bills were sold. These months were excluded from the averaging process.

3. No deduction has been made for transaction costs, custody or management fees.

ANNEX B

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR 90-DAY FINANCE COMPANY PAPER

Data Source:

- Rates for 90-day Finance Company Paper are as compiled and published by the Bank of Canada -- the Bank's best estimate of operative market trading levels on the last Wednesday of each month for major borrowers' paper. They were obtained from CANSIM, series B14017. No data were available for dates prior to 1956; rates for the period 1952 through 1955 are assumed, on the basis of subsequent relationships, to have been 88 basis points higher than the rates for three-month Treasury Bills.

- The sources of Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

- Purchase at the beginning of the year of 90-day Finance Company Paper at the average of yields on the last Wednesday of each month in the first quarter. Reinvestment at correspondingly calculated rates for each subsequent quarter of the year.

- Nominal rate of return constitutes the accumulated interest on $100.

- Inflation-adjusted rate of return derived as in Annex A.

Method - Year-End Rates

As above, except

- CPI data used are for December of previous and current years.

(Examples of these methods as applied to three-month Treasury Bills will be found in Annex A.)

Note:

1. No deduction has been made for transaction costs, custody or management fees.

ANNEX C

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR THREE TO FIVE-YEAR GOVERNMENT OF CANADA BONDS

Data Source:

- Monthly average yields on three to five-year Government of Canada bonds are as compiled and published by the Bank of Canada -- based on the midpoints between the closing bid and asked prices in the market on the last Wednesday of each month on direct debt payable in Canadian dollars, including extendible issues but excluding Canada Savings Bonds. They were obtained from CANSIM, series B14010.

- The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

- Purchase at the beginning of the year at par of a notional four-year bond bearing a coupon equal to the average yield over the preceding 12 months on outstanding issues with three to five years to maturity. The coupon is paid in two semi-annual instalments.

- Sale of this bond at the end of the year, when it has three years to maturity, at a price which gives a yield equal to the average of the 12 monthly yields over the year on outstanding issues with three to five years to maturity.

- Nominal rate of return constitutes notional coupon rate plus (minus) indicated capital gain (loss) on sale.

- Inflation-adjusted rate of return derived as in Annex A.

Method - Year-End Rates

As above, except

- Notional coupon is average yield in December of previous year on oustanding issues with three to five years to maturity.

- Yield on sale is average yield in December of current year on outstanding issues with three to five years to maturity.

- CPI data used are for December of previous and current years.

(Examples of these methods as applied to long-term Government of Canada Bonds will be found in Annex F.)

Notes:

1. The coupon rate and yields used in the calculations are as conventionally used in the Canadian bond market, i.e. the semi-annual interest payment is not compounded.

2. The life to maturity of the bond at the time of purchase is assumed to be four years, and hence assumed to be three years at the time of sale.

3. Although the mix of outstanding issues with a term to maturity of three to five years may change during the course of the year, the assumption here of the applicability of their average yield to four-year and three-year bonds is not altered. A flat yield curve between three and four years is assumed.

4. No deduction has been made for transaction costs, custody or management fees.

ANNEX D

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR FIVE-YEAR GUARANTEED INVESTMENT CERTIFICATES

Data Source:

- Rates for five year Guaranteed Investment Certificates are as compiled and published by the Bank of Canada -- the monthly averages of the weekly rates quoted by a number of large trust companies. They were obtained from CANSIM, series B14022. Monthly data are not available prior to 1964 and the rates used for the period 1951 through 1963 are the average of quarterly data compiled by the Bank of Canada.

- The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

- Purchase at the beginning of the year at par of a notional three-year certificate bearing interest equal to the average rate over the preceding 12 months; interest assumed to be payable semi-annually.

- Liquidation of this certificate at the end of the year, when it has two years to maturity, at a price to yield the correspondingly calculated average yield on issues during the 12 months in which the certificate was held.

- Nominal rate of return constitutes interest plus (minus) indicated capital gain (loss) on sale.

- Inflation-adjusted rate of return derived as in Annex A.

Method - Year-End Rates

As above, except

- Interest rate is average of weekly yields for the month of December of previous year from 1964 through 1978, and the average for the last quarter from 1951 through 1963.

- Yield on liquidation is average of weekly yields for the month of December of current year.

- CPI data used are for December of previous and current years.

(Examples of these methods as applied to long-term Government of Canada Bonds will be found in Annex F.)

Notes:

1. The yields are as conventionally used in the Canadian bond market, i.e. the semi-annual interest payment is not compounded.

2. The life to maturity of the certificate at the time of purchase is assumed to be three years, and hence assumed to be two years at the time of sale.

3. The assumption here of the applicability of the five-year yield to three-year and two-year certificates implies a flat yield curve from two through three years.

4. No deduction has been made for transaction costs, custody or management fees.

ANNEX E

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR CONVENTIONAL MORTGAGES

Data Source:

- The basic data in respect of conventional mortgages are as compiled by Central Mortgage and Housing Corporation and published by the Bank of Canada -- a simple average of rates as at mid-month charged by a number of large institutional lenders for prime residential mortgage loans. They were obtained from CANSIM, series B14024. The published rates were reduced in each case by 50 basis points to allow for costs of servicing.

- The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

- Purchase at the beginning of the year at par of a relatively new conventional mortgage with a 25-year amortization term and a 3-year remaining contractual term, bearing interest equal to the simple average of rates over the preceding 12 months less 50 basis points; interest assumed to be payable semi-annually.

- Sale of this mortgage at the end of the year, when it has 2 years to maturity, at a price to yield the corresponding average yield over the current year, again less 50 basis points.

- Nominal rate of return constitutes interest plus (minus) indicated capital gain (loss) on sale.

- Inflation-adjusted rate of return derived as in Annex A.

Method - Year-End Rates

As above, except

- Interest rate is average yield in December of previous year.

- Yield on sale is average yield in December of current year.

- CPI data used are for December of previous and current years.

(Examples of these methods as applied to long-term Government of Canada Bonds will be found in Annex F.)

Notes:

1. The yields are as conventionally used in the Canadian bond market, i.e. the semi-annual interest payment is not compounded.

2. The mortgages underlying the calculations are relatively new mortgages with a 25-year amortization term and with a 5-year contractual term, i.e., they are renegotiable at 5-year intervals. The remaining contractual term at the time of purchase is assumed to be three years, and hence is assumed to be two years at the time of sale.

3. No adjustment has been made for the principal component of "blended" payments of interest and principal which would have to be reinvested at current rates. Principal repayments on the mortgage assumed for the purposes of calculations would, however, be very small and the effect on the overall rate of return would not be material.

4. The assumption here of the applicability of the average yield to three-year and two-year mortgages implies a flat yield curve from two years up. It should be noted that the renegotiability of mortgages at 5-year intervals was not prevalent until the mid-sixties, and the results for earlier years are in this sense artificial.

5. A reduction of 50 basis points has been made from quoted rates as an allowance for costs of administration. No deduction has been made for other transaction costs, custody or management fees.

ANNEX F

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR LONG-TERM GOVERNMENT OF CANADA BONDS

Data Source:

. Monthly average yields on long-term Government of Canada bonds (outstanding issues having 10 years or more to maturity) are as compiled and published by the Bank of Canada -- based on the mid-points between the closing bid and asked prices in the market on the last Wednesday of each month on direct debt payable in Canadian dollars, including extendible issues but excluding perpetuals and Canada Savings Bonds. They were obtained from CANSIM, series B14013 for the years 1936 through 1978 and series B14012 for the years 1919 through 1935.

. The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

. Purchase at the beginning of the year at par of a notional 15-year bond bearing interest equal to the average yield over the preceding 12 months on outstanding issues of 10 years and over to maturity payable semi-annually.

. Sale of this bond at the end of the year, when it has 14 years to maturity, at a price to yield the average of the yield over the current year on outstanding issues of 10 years and over to maturity.

. Nominal rate of return constitutes the coupon rate plus (minus) indicated capital gain (loss) on sale.

. Inflation-adjusted rate of return derived as in Annex A.

Example:	Average yield:	1977	8.70%	1978	9.27%
	CPI Average:	1977	160.82	1978	175.15

Proceeds of a 14-year 8.70% bond to yield 9.27%	95.58
Deduct initial investment	-100.00
Capital loss (-)	- 4.42
Coupon rate	8.70
Nominal rate of return, 1978	4.28%

Inflation-adjusted rate of return, 1978:

$$((100 + 4.28) \times \frac{160.82}{175.15}) - 100 = -4.25\%$$

Method - Year End Rates

As above, except

- Notional coupon is average yield in December of previous year on oustanding issues of 10 years and over to maturity.

- Yield on sale is average yield in December of current year on outstanding issues of 10 years and over to maturity.

- CPI data used are for December of previous and current years.

Example:	Yield,	December:	1977	8.77%	1978	9.68%
	CPI	December:	1977	167.2	1978	181.3

Proceeds of a 14-year 8.77% bond to yield 9.68%	93.10
Deduct initial investment	-100.00
Capital loss (-)	- 6.90
Coupon rate	8.77
Nominal rate of return, 1978	1.87%

Inflation-adjusted rate of return, 1978:

$$((100 + 1.87) \times \frac{167.2}{181.3}) - 100 = \qquad -6.05\%$$

Notes:

1. The coupon rate and yields used in the calculations are as conventionally used in the Canadian bond market, i.e. the semi-annual interest payment is not compounded.

2. The average of outstanding issues with maturities of 10 years and over is assumed to be 15 years at the time of purchase and to be 14 years at the time of sale.

3. Although the mix of outstanding issues with maturities of 10 years and over may change during the course of the year, the assumption here of the applicability of their average yield to 15-year and 14-year bonds is not altered. A flat yield curve between 14 and 15 years is assumed.

4. The series of bonds used in the yield averages for the period 1936 through 1978 is not strictly comparable with the series used for earlier years. In 1936, when data were available for both series, the older series of yields averaged 23 basis points higher than the new series.

5. No deduction has been made for transaction costs, custody or management fees.

ANNEX G

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR

10 PROVINCIAL BONDS (MCLEOD YOUNG WEIR LIMITED)
10 INDUSTRIAL BONDS (MCLEOD YOUNG WEIR LIMITED)

Data Source:

. The interest rates used for provincial and for industrial bonds are based on average mid-market closing prices on the last business day of the month, compiled by McLeod Young Weir Limited, Toronto, and republished by the Bank of Canada. These indices have gained general acceptance in the Canadian financial community as indicators of the yield on these classes of securities. In each instance, McLeod Young Weir uses a portfolio of recently issued bonds of 'above-average to prime-quality' borrowers in their respective categories. The exact composition of the portfolios at any one time is known and changes frequently as 'stale' bonds are dropped and replaced by bonds of more recent vintage. The average of the terms to maturity of the bonds in each portfolio has recently been about 20 years and McLeod Young Weir seeks to maintain reasonable distributions at all times between provinces or industries. Data were obtained from CANSIM, series B14014 and B14016 respectively.

. The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

. Purchase at the beginning of the year at par of notional 20-year bonds bearing interest equal to the average month-end yields over the preceding 12 months on 10 bonds with average terms to maturity of about 20 years payable semi-annually.

. Sale of these bonds at the end of the year, when they have 10 years to maturity, at prices to yield the averages of the month end yields over the year of 10 bonds with average terms to maturity of about 20 years.

. Nominal rates of return constitutes interest plus (minus) indicated capital gain (loss) on sale.

. Inflation-adjusted rate of return derived as in Annex A.

Method - Year-End Rates

As above, except

. Notional coupon rates are month end yields in December of previous year on 10 bonds.

- Yields on sale are month end yields in December of current year on 10 bonds.

- CPI data used are for December of previous and current years.

(Examples of these methods as applied to long-term Government of Canada Bonds will be found in Annex F.)

Notes:

1. The coupon rates and yields used in the calculations are as conventionally used in the Canadian market, i.e. the semi-annual interest payment is not compounded.

2. The use of an average life to maturity of 20 years at the time of purchase was determined by the data source, and was assumed to be 19 years at the time of sale.

3. The assumption here of the applicability of the yields on 20-year bonds to both 19-year and 20-year bonds implies flat yield curves from 19 through 20 years.

4. No deduction has been made for transaction costs, custody or management fees.

ANNEX H

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR STOCKS

Data Source:

. To arrive at rates of return on stocks, it is necessary to make use of measures of changes in capital values and of common stock yields. The Toronto Stock Exchange, in its new '300' stock price index system, provides both stock price and dividend yield data for the past two decades. The stock dividend yield is calculated by taking the indicated dividend to be paid per share of stock over the coming 12 months and dividing it by the current price of the stock. These data were obtained from CANSIM, series B4237 for the TSE closing indices for 1956 through 1978, and series B4245 for the TSE stock dividend yields for 1956 through 1978.

. For earlier periods, recourse was made to the Statistics Canada Investors Composite Index of common stock prices as republished in Urquhart, M.C., ed. Historical Statistics of Canada, The MacMillan Company of Canada Limited, Toronto, 1965. Series H-635 and H-641 cover respectively the annual 12-month averages and the December average. Series H-617 in the same source reproduces a common stock yield series compiled by Moss, Lawson and Company, Toronto, a series still being produced. The Moss, Lawson and Company series, however, is based on a much narrower sample of stocks than the TSE index because it is designed to reflect the yield on dividend-paying stocks rather than on a representative sample of all stocks, whether paying dividends or not; it therefore tends to show consistently higher payout results than the stock price index. In order to provide a greater degree of comparability it has been reduced by 75 basis points.

. The sources of the Consumer Price Index (CPI) are shown in Annex A.

Method - Annual Average Rates

. Purchase at the beginning of the year of the index at the average of the 12 monthly levels during the previous year.

. Sale at the end of the year of the index at the average of the 12 monthly levels during the year over which the stocks were held.

. Dividend yield estimated to be the average for the preceding and current years of the yields derived by expressing for each year the sum of the dollar amounts anticipated at the end of each month of dividends to be paid over the succeeding 12-month period as a percentage of the sum of the index levels at the end of each of the 12 months.

- Nominal rate of return constitutes the dividends received plus (minus) capital gain (loss) on sale.

- Inflation-adjusted rate of return derived as in Annex A.

The calculations in respect of 1978 are shown below by way of example.

The capital gain was derived as follows:

$$\left(\frac{\text{TSE Composite Index Average 1978}}{\text{TSE Composite Index Average 1977}} - 1\right) \times 100$$

$$\left(\frac{1159.1}{1009.9} - 1\right) \times 100 = \qquad 14.77\%$$

The assumed dividend yield was then calculated, starting with the following formula:

$$\frac{\text{TSE Stock dividend yield (composite)} \times \text{TSE Composite month-end index summed January through December}}{\text{TSE Composite month-end level summed January through December}} \times 100$$

This formula produced results of 4.819% for 1977 and 4.477% for 1978. Their average of 4.648% was used for the dividend yield in the annual average rate of return calculation for 1978.

The nominal rate of return for 1978 was thus made up of

Capital gain	14.77%
Dividend income	4.65
Nominal rate of return, 1978	19.42

The inflation-adjusted rate of return for 1978 was then

$$\left((100 + \text{Nominal Rate of Return}) \times \frac{\text{CPI average 1977}}{\text{CPI average 1978}}\right) - 100$$

$$\left((100 + 19.42) \times \frac{160.82}{175.15}\right) - 100 \quad = \quad 9.64\%^{*}$$

* calculated from unrounded figures.

(The calculation of annual average dividend income for the years 1934 through 1956 is illustrated by the following example for 1950:

Moss, Lawson & Co. averages:	1949	6.54%	1950	5.96%
Average of 1949 and 1950 averages:				6.25%
Deduct 0.75 basis points				-0.75
Dividend Income, 1950				5.50

For 1915 through 1933, when the Moss, Lawson & Co. averages were not available, the method was similar but averages of 4.75%, rather than 5.96% in the example above, were assumed.)

Method - Year-End Rates

As for Annual Average Rates, except

. Purchase is at the index year-end level for the previous year.

. Sale is at the index year-end level.

. Nominal rate of return is derived by compounding monthly the sum of the percentage change in the index and one-twelfth of the anticipated annual dividend yield indicated at the beginning of the month.

Example:	TSE Composite Index month-end	December 1977	1059.6
		January 1978	998.4
	Stock dividend yield	December 1977	4.73
	CPI December: 1977	167.2 1978	181.3

Nominal rate of return, 1978:

Capital loss, January $(\frac{998.4}{1059.6} - 1) \times 100$ = -5.78

Dividend income, January (4.73 divided by 12) = 0.39

January 1978 nominal rate of return -5.39%

The 12 monthly results are then compounded to arrive at a year rate:

((1 - 0.0539)(1   )(1   ), etc. - 1) x 100, yielding 29.15%

Inflation-adjusted rate of return, 1978:

$((100 + 29.15) \times \frac{167.2}{181.3}) - 100$ = 19.10%

(The calculation of dividend income for the years 1934 through 1955 is illustrated by the following example for 1950:

Moss, Lawson and Co. average, 1950	5.96%
Deduct 0.75 basis points	5.21
Apply to 1950 average stock index $\frac{(5.21 \times 131.6)}{100}$	6.86
Express as percentage of December 1949 stock index $(\frac{6.86}{117.9} \times 100)$	5.81
Derive monthly average (divide by 12)	0.484
Compound monthly average for year $((1 + 0.00484)^{12}) - 1) \times 100$, to produce an annual estimate for Dividend income, 1950	5.97%

For the years 1916 through 1933, when the Moss Lawson & Co. averages were not available the method was similar but averages of 4.75%, rather than 5.96 in the example above, were assumed.)

Notes:

1. No deduction has been made for transaction costs, custody or management fees.

2. The two stock prices indices were linked by applying the ratio of the two indices in 1956, the earliest common year.

3. The year-end rates as calculated reflect monthly reinvestment of dividends while the annual average rates do not. An annual rate of 5% if compounded monthly is equivalent to 5.12%.

ANNEX I

METHODOLOGY FOR DERIVING THE INFLATION-ADJUSTED RATE OF RETURN FOR

UNITED STATES TREASURY BILLS
UNITED STATES LONG TREASURY BONDS
UNITED STATES LONG CORPORATE BONDS
UNITED STATES STOCKS

Data Source and Methodology:

The basic nominal rate of return data in respect of these United States instruments were the product of research done by R.G. Ibbotson and R.A. Sinquefield as published in the Journal of Business (Volume 49, Number 1, January 1976) under the title: "Stocks, Bonds, Bills and Inflation: Year by Year Historical Returns 1926-1974".

Ibbotson and Sinquefield used year-end data and appear to have used methods for calculating rates of return on the various instruments (bills, corporate and government bonds, and equities) not unlike those described above for Canadian data. Their basic source for government securities was the CRSP(1) U.S. Government Bond File. Rather than using yields on three-month Treasury Bills, as was done to arrive at the Canadian results, or the average yield on a representative portfolio of Treasury Bills, Ibbotson and Sinquefield chose to base their Treasury Bill yield on a single issue, namely, the shortest maturity in excess of 30 days. In addition, since the CRSP U.S. Government Bond File contained no Treasury Bills prior to 1931, although they were first issued in 1929, rates of return on short-term coupon bonds were used in lieu of those on Treasury Bills for the period 1926-1930.

Ibbotson and Sinquefield's Treasury Bond rate of return series was also based on the yields obtainable on a single bond rather than on the average yield of a portfolio of bonds. Their argument in favour of such a course was that often only a single long-term U.S. Treasury Bond met the criteria they had established to avoid distortions of the rates of return on many long Treasury Bonds caused by special tax considerations, poor marketability, and/or special redemption or call features.

(1)Centre for Research in Security Prices (Graduate School of Business, University of Chicago).

Rates of return on corporate bonds used in the Ibbotson and Sinquefield analysis for the period 1926-1945 were derived from Standard and Poor's High-Grade Composite Bond Index. Thereafter they were based on the yield on a Salomon Brothers' High Grade Long-Term Corporate Index designed to approximate the entire high-grade corporate bond market in the 20-year maturity range, which the authors reconstructed from its inception in 1969 back to 1946.

Rates of return on United States equities were based on the Standard and Poor's Composite Index (a broader based measure than the Dow Jones), adjusted for dividend payouts.

Inflation-adjusted rates of return were produced by deflating nominal rates of return by the United States Consumer Price Index.

APPENDIX 11

MEASURING PENSION FUND INVESTMENT PERFORMANCE 1961-1978

Nicholas Rost van Tonningen*

This appendix examines the effect of investment management on the rates of return realized by pension funds by comparing actual pension fund performance during the period 1961-1978 (no reasonably reliable data were available before the early 1960s) with the rates of return(1) that appeared to have been obtainable during this period:

- on individual financial assets,
- on certain fixed composition portfolios, and
- under conditions in which investment managers were given hypothetical "perfect foresight" with respect to future rates of return.

To do the analysis, three sets of data were required for the period in question: 1. those illustrating actual pension fund performance; 2. others showing the rates of return that were obtainable on various classes of financial assets; and 3. still others illustrating the scope that existed for realizing rates of return on portfolios in excess of those obtainable on individual classes of assets through periodic changes in the portfolio mix.

Inflation-adjusted rates of return were used; these were defined as the annual rates of return on a nominal basis adjusted for the change in the Consumer Price Index (CPI). (See Appendix 10 for details on how rates of return were calculated.) Adjustment for inflation was deemed appropriate because of its relevance to any discussion of the possibility of maintaining the real value of pension benefits over time. In addition, inflation-adjusted rates allow for a ready comparison of investment performance in different years or time periods. Finally, given that security of principal is a fundamental investment objective, inflation-adjusted rates of return indicate the degree of success achieved in maintaining principal values in real terms during periods of varying inflation.

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* Mr. Rost van Tonningen was a consultant to the Task Force on Retirement Income Policy. This appendix has been updated by members of the Task Force.

(1) All these are time weighted data, i.e. data which are not sensitive to the size and timing of cash flows and which, therefore, can be used to evaluate differences in investment performance/skills during different time periods.

A. Measuring Actual Pension Performance

There are several investment performance measuring services in Canada. In this instance, pension fund performance data were those calculated by Wood Gundy Limited's Performance Measurement Service for the period 1961-1978. In 1977 the survey covered more than 300 pension plans with over $12 billion in assets, i.e. 40% of the total assets of trusteed pension plans. The results are summarized in Table 1. It is important to note that the results reported include transaction costs but do not include the cost of portfolio management and administration.

Table 1

	1961-1966	1967-1972	1973-1978	1961-1978
	(compound annual average inflation-adjusted rates of return)			
Actual pension fund investment results at				
First quartile break	4.9	6.2	-1.6	3.1
Median	3.7	3.6	-3.2	1.3
Third quartile break	2.6	1.5	-4.9	-0.3

Source: Data provided by Wood Gundy Limited converted to inflation-adjusted rates on a year-end basis as described in Appendix 10.

B. Rates of Return on Individual Financial Assets

Appendix 10 outlined how the available data series on the yields of various financial assets were utilized to construct rate of return data series. These rates of return were of the time-weighted variety,(2) and hence compatible with the pension fund rate of return data.

Table 2 below illustrates the inflation-adjusted rates of return on a year-end basis that appear to have been obtainable on various financial assets during the period 1952-1978.(3)

(2)With a sub-period equal to one year.

(3)1961-1978 averages were also included to provide a ready comparison with data in Table 1.

Table 2

Inflation-Adjusted Rates of Return Realized on Various Canadian Financial Assets, 1952-1978

	Compound Annual Rates of Return					
	1952-78	1955-60	1961-66	1967-72	1973-78	1961-78
3-month Treasury Bills	0.9	1.3	1.9	1.2	-1.2	0.6
Medium-term Canada Bonds	0.9	1.0	2.3	1.9	-3.2	0.3
Long Term Canada Bonds	0.0	-1.5	2.4	0.7	-3.9	-0.3
10 Provincials McLeod Young Weir	0.5	-2.1	1.8	1.5	-2.9	0.1
10 Industrials McLeod Young Weir	0.8	-0.2	1.3	1.8	-2.5	0.2
Finance Paper	1.8	2.2	2.6	2.2	-0.3	1.5
Guaranteed Investment Certificates	2.0	2.1	2.9	2.7	-0.7	1.6
Conventional Mortgages	3.4	3.9	4.2	4.1	0.4	2.9
Equities	4.8	5.5	7.7	6.9	-3.4	3.6
Median Pension Fund Performance (Table 1)	n.a.	n.a.	3.7*	3.6*	-3.2*	1.3*

* after transaction costs.

A comparison of the results in the last four columns of Table 2 with the data in Table 1 provides one indication of the effectiveness of pension fund management during the period 1961-1978. When a rough allowance is made for transaction costs, median pension fund performance, on an inflation-adjusted basis, resulted in investment results which, over the 18-year period taken as a whole, compared very favourably with the rates of return that could have been obtained by investments in Treasury Bills, medium-term Canada bonds and securities with a long-term to maturity, but significantly below those available on mortgages and equities.

For individual sub-periods, pension fund performance varied considerably. During the two six-year periods 1961-1966 and 1967-1972, median pension fund performance was well in excess of the average rate of return on most fixed-income securities, but still well below the rates of return on equities. During the period 1973-1978, inflation-adjusted rates of return on most classes of financial assets were generally unsatisfactory and this state of affairs was reflected in generally poor pension fund performance.

C. Benchmark Portfolios

Data regarding the annual inflation-adjusted rates of return on individual Canadian financial assets were used to construct a number of 'benchmark portfolios' of two different types, shown in sections A and B of Table 3. In every instance, it was assumed that the portfolio was started on January 1, 1952 with a fixed amount of money and that no further net new funds were added. Results were calculated annually and were not weighted to reflect the fact that the volume of assets involved tended to grow over time as a result of the reinvestment of income received. The resultant data, therefore, were also of the nature of time-weighted rates of return, with a sub-period equal to one year.

One type of portfolio featured a fixed composition. This meant that the portfolio mix was held constant from year to year. In effect, after all income accruals and capital value changes had been taken into account at year end, the portfolio composition was restored to its original mix before commencing the next year's operations. These adjustments were the only transactions deemed to have taken place each year.

Fixed composition portfolios were included in the appraisal procedure in order to try to establish how well, or how badly, a pension fund management policy of 'benign neglect' would have fared vis-à-vis actual, fully-managed pension funds. In other words, the performance of fixed composition portfolios vis-à-vis that of the 'managed' pension funds measured by Wood Gundy could be used as a rough indicator of the benefits derived from portfolio management. The program for fixed composition portfolios made no allowance for transaction costs. Since the need for transactions was very limited, provision for transaction costs would not likely have made an appreciable difference to the rates of return. This is in contrast to the actual fund experience where costs are associated with the investment of new cash flows and of repayments.

Among the fixed composition portfolios illustrated in section A of Table 3, Portfolio 1 reflects approximately the average portfolio composition of trusteed pension funds in 1957, while portfolio 2 reflects the composition in 1975. (Stat. Can. No. 74-201). Portfolio 5 reflects the average distribution of assets of the pension funds covered by the performance measuring service in 1976. The other portfolios were chosen arbitrarily to illustrate (3) the performance of a conservative fixed-income portfolio, (4) the effect of a heavy concentration on liquid instruments, and (6) the performance of an equity-oriented fund.

As may be seen in Table 3, the rate of return performance of pension funds at the first-quartile break exceeded by a significant margin that achieved by all the illustrative fixed composition portfolios over the 1961-1978 period despite the exclusion from the latter of transaction costs. Pension funds at the third quartile break did much worse. Median pension fund performance for the entire 18-year period, when some allowance is made for transaction costs, was not far off the results achieved by three of the fixed-composition portfolios, well above the results of the portfolio most heavily invested in bonds, and well below the portfolios with the largest equity components.

Table 3

Actual and Potential Investment Performance 1961-1978

	Comm. Paper	Prov. Bonds	Conv. Mortg.	Equities	1961-1966	1967-1972	1973-1978	1961-1978
					(average annual real rates of return)			
					%	%	%	%
A. Fixed composition portfolios								
1	10	70	10	10	2.7	2.4	-2.4	0.9
2	10	50	15	25	3.7	3.3	-2.3	1.5
3	10	40	40	10	3.4	3.1	-1.4	1.7
4	55	15	15	15	3.5	3.1	-1.0	1.8
5	5	35	20	40	4.7	4.2	-2.3	2.1
6	10	15	15	60	5.8	5.2	-2.4	2.8
B. Optimal strategy portfolios*								
1 Long-term strategic perception					7.7	6.3	2.8	5.6
2 Short-term strategic perception					6.7	8.0	-0.3	4.7
C. Actual pension fund investment results**								
1 First quartile break					4.9	6.2	-1.6	3.1
2 Median performance					3.7	3.6	-3.2	1.3
3 Third quartile break					2.6	1.5	-4.9	-0.3

* Funds are invested assuming the investment manager has perfect foresight about future rates of return for either one year, or four years, for the following financial assets: Treasury Bills, commercial paper, 5-year Guaranteed Investment Certificates, conventional mortgages, Government of Canada Bonds, provincial bonds, industrial bonds and Canadian equities, subject to the restraint that no more than 20% of the portfolio may be switched into more promising securities in any one year. The long-term strategic perception involves the four-year foresight and calls for returns to be maximized over four years subject to an annual re-evaluation on the basis of the most recent four-year data; the short-term perception involves the one-year foresight and calls for returns to be maximized over one year.

** After transaction costs. See text.

The other type of benchmark, the 'optimal strategy' portfolios, involved a computer program using the same annual rate of return data on individual Canadian financial assets which underlie Table 2. It involved the calculation of the maximum rates of return that could have been achieved, if the investment manager had known in advance what the rates of return on the various assets would be in the future and if he had made his investment decisions on that basis. Two limitations were imposed on the manager. Firstly, that it would not be practical to liquidate an entire portfolio in any one year and reinvest the proceeds; and secondly, that his 'foresight' would only operate with respect to certain specified time frames.

The first limitation resulted in the incorporation in the computer program of 'turnover restraints', i.e. in the placing of specific upper limits on the portion of the portfolio that could be liquidated, and reinvested, in any one year. In the examples used here a 'turnover restraint' of 20% was used; i.e. at the end of each calendar year the manager could liquidate the 20% of his total portfolio that promised to be least profitable during the foreseeable future and redeploy the proceeds in classes of securities that would be most profitable. This appeared to be a realistic limitation for the following reasons:

- in real life, massive portfolio revamping within a limited time frame is seldom possible for a portfolio of any significant size.

- given the relatively limited depth of the Canadian financial markets, any attempt at a major portfolio realignment would likely have led to an erosion in the value of securities being sold and an appreciation in the price of securities being sought as replacements. This would significantly alter the cost of making a change.

- during the period under review (1961-1978) pension funds in Canada experienced substantial net new cash flows. As a result, the emphasis in pension fund management was perhaps less on rearranging existing portfolios than on finding profitable outlets for new cash.

- changes in pension fund investment objectives and policies tend to be implemented at the margin. In other words, changes usually are implemented by changing the distribution of new cash flows rather than by major portfolio restructuring initiatives.

The second limitation restricted the manager's foresight to specific time frames. This constraint was introduced to recognize that no manager would have such perfect foresight as to be able to forecast, with any degree of confidence, rates of return over periods as long as, say, 20 or 25 years. In the end, results were produced for two separate time frames: a one-year foresight and a four-year foresight. In the first case, it was assumed that, at the beginning of each calendar year (i.e. the time at which investment decisions were made), the manager would have perfect knowledge with respect to the rates of return that would be forthcoming during that calendar year (the 'short' option).

Selection of this time frame stemmed from the view that investment professionals should normally be expected to have at least some reasonable perception with respect to the short-term economic and financial outlook. In the second case, results reflected a situation in which the manager at the beginning of each calendar year would have knowledge of the average annual rate of return for the next four calendar years - four years being roughly the length of the stock market cycle in Canada (the 'long' option). This alternative would leave some room for 'positioning', the practice whereby a manager might accept sub-optimal rates of return in the short run in order to optimize overall rates of return over a longer term.

In making his decisions as to what assets to liquidate, the manager would use his foresight to eliminate the assets which would generate the lowest rate of return during the time frame in question. To avoid complicating the long foresight program unnecessarily, it was provided that this foresight would relate only to average annual rates of return during the entire four-year period and not to rates of return on individual years within the four-year period.

The comparison in Table 3, of actual median pension fund performance with that of the optimal strategy benchmark portfolios is highly theoretical but provides some additional perspective. Again it should be noted that the benchmark portfolios take no account of transaction costs. If the median pension fund in 1976 had experienced average cash flow and had turned over 10% of its portfolio once during the year, the estimated before-transaction-cost return would have been 25 to 30 basis points higher.

Apart from transactions costs per se, the management of an investment portfolio necessarily involves administrative and professional expense, and the net rate of return will be effectively lowered by these charges. Management fees are conventionally quoted as percentages of the funds administered or in thousands of dollars per million dollars of funds. The charges are higher, in relative terms, for smaller than for larger funds. In the case of the latter, at least, fees are often negotiable. For a fund of $50 million - a relatively large fund - fees might range from about $60,000 to about double this amount, equivalent to between 12 and 24 basis points of return. For a fund of $10 million, the deductions to arrive at a net rate of return would be about twice as large.(4)

In summary, over the 18-year period 1961 through 1978 taken as a whole, performance of the median pension fund, on an inflation-adjusted basis, compared well with the inflation-adjusted rates of return that were obtainable on bonds and Treasury Bills, and compared poorly with the returns available on conventional mortgages and equities. The performance of the median fund was considerably above that of the hypothetical fixed composition fund which maintained unchanged the

(4)Based on information provided by P. Morgan McCague of James P. Marshall, Inc., Toronto.

typical portfolio mix of trusteed pensions at the beginning of the period (line A.1 in Table 3), but below that of hypothetical fixed composition funds which were more oriented to equities and mortgages. As might have been expected, over the period as a whole the optimal strategy portfolios, which were given foresight, outperformed the actual pension funds even at the first quartile break, although for the period 1967 through 1972, after allowance for transaction costs, the actual first quartile fund achieved a slightly higher return than the simulated fund with four-year foresight.

Inflation-adjusted rates of return earned by pension funds fell dramatically in the 1973-1978 period as did those of the fixed composition portfolios. The returns earned by the simulated 'optimal strategy' portfolios, which provided for a significant degree of foresight, also fell during the period suggesting that maintaining investment performance under conditions of severe inflation is extraordinarily difficult.

On balance, the data do not lend themselves to ready conclusions. Although pension funds vary greatly in their performance, it may be unrealistic to expect their performance as a whole to differ widely from the performance of the financial markets in which they play an extremely important role.

APPENDIX 12

INDEXED BONDS

Nicholas A. Rost van Tonningen, John Sargent, Robin Miller and Patrick Grady*

A. Introduction

1. Objective. The purpose of this appendix is to discuss the pros and cons of establishing a system of indexed bonds as a means of assisting employers in the event that governments (federal and/or provincial) should require them to adjust pension payments under their pension plans to compensate for inflation.(1) The main body of this appendix is divided into three parts. This introduction describes briefly the mechanics of indexed bonds, the way that inflation may affect the cost of indexed pensions and, hence, the reasons why indexed bonds are being considered as a means of offsetting such inflationary impacts. It also notes the role of pension fund money in the financial system in Canada. The second part appraises the possible impact of indexed bonds on the economy generally, on financial markets, and on government operations. It also briefly reviews experience abroad with indexed bonds. The third part deals with the conclusions arrived at from the foregoing discussion. In addition, there are two annexes. One of these provides an estimate of the possible demand for, and supply of, indexed bonds. The other comments on the risk that with indexed bonds, public debt servicing costs might become less predictable.

2. The Mechanics of Indexed Bonds. The indexing of securities involves the periodic adjustment over time of interest and/or principal payments on those securities in line with recorded changes in some predetermined standard - the 'index'. The choice of the index and the precise method of linkage to changes in principal or interest is a function of the ingenuity of borrowers and of their perception of the potential demand in the market for specific indexing arrangements.

The following discussion focuses only on two simple types of indexed bonds: 1) the 'principal compensation' bond and, 2) the 'indexed principal' bond. In the case of the former, compensation is paid at the end of each year for the decline in the real value of the bond's nominal value during that year. At maturity, therefore, only the original

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(1) It should be pointed out that this appendix does not explore the equity issues raised by the indexed bond approach. While indexed bonds are examined here solely as a technique to facilitate indexed pensions, the equity question would undoubtedly merit attention should serious consideration be given to adopting this approach.

nominal value of the bond, adjusted for the inflationary experience of the last year, would need to be repaid, since the lender would already have been compensated for the loss in the real value of his original investment during each of the previous years. The indexed principal bond, on the other hand, provides for repayment of principal in real terms only upon maturity. In that case, full compensation for the loss in real value of the principal amount of the bond is paid when the bond matures.

In both cases, a specific 'real' rate of interest would also be paid annually. Mechanically, the real value interest stream can be calculated by applying the specified real rate of interest on the bond (i.e. 2%) to the indexed value of the bond's principal at the end of each interest period. Table 1 illustrates how the alternative systems would work based on two five-year indexed bonds, one of the principal compensation variety and the other of an indexed principal type, each carrying a 2% 'real value' coupon. This illustration further assumes that, during the five-year life of these bonds, the annual inflation experience was as follows: 3%, 5%, 6%, 4%, 2%. This would have produced the following stream of payments with respect to interest, inflation compensation, and principal.

Table 1

Debt Servicing Schedules for Principal Compensation and Indexed Principal Bonds

	Principal Compensation				Indexed Principal			
Year	Interest	Compensation	Principal	Other	Interest	Compensation	Principal	Other
I (3%)	2.06	3.00	-	-	2.06	-	-	-
II (5%)	2.10	5.00	-	-	2.16	-	-	-
III (6%)	2.12	6.00	-	-	2.29	-	-	-
IV (4%)	2.08	4.00	-	-	2.38	-	-	-
V (2%)	2.04	2.00	100.0	-	2.43	21.61	100.00	-
Interest earned on all payments made during years I to IV				3.84				1.31
Value at maturity of stream of principal and/or interest payments to the lender, assuming reinvestment of all payments received at prevailing interest rates				134.24				134.24

As noted above, the real value interest rate concept requires that interest payments be calculated on the basis of the indexed value of the bond's principal at the end of each year. This is quite simple in the case of the principal compensation bond, where the principal

value series for the purpose of calculating interest payments is as follows: \$103, \$105, \$106, \$104 and \$102, and where 2% of \$103, for instance, is \$2.06. In the case of the indexed principal bond, however, where no inflation compensation payments are made until maturity, a compounding element occurs in the principal base used for calculating interest payments. Interest payments are, therefore, based on the following series: \$103, \$108.15, \$114.64, \$119.22, \$121.61. The \$108.15 principal base for year II, in this case, is derived by multiplying the \$103 principal value at the end of year I by 1.05 (which reflects the second year's rate of inflation).

3. The Impact of Inflation on Pensions. Generally speaking, as shown in the Task Force report, inflation causes fluctuations and uncertainties in the cost of defined benefit pension plans even in the case of those that are not indexed. The extent to which cost fluctuations occur in individual plans varies widely at any given level of inflation and depends on a number of factors. These include the economic assumptions used, the method of valuation of assets and liabilities, the extent to which a plan may already have been underfunded, the provisions for amortization of unfunded liabilities and the type of plan concerned. Moreover, it appears that the more a defined benefit plan is indexed for inflation, the greater the range of cost fluctuations it is likely to experience. By definition, however, there is no impact on money purchase or other defined contribution plans because liabilities in such plans are simply a function of contribution levels and of realized rates of return.

Employers would feel more confident with respect to the cost of their pension plans if the rate of return on their pension fund assets were always to reflect the current inflationary experience. Ideally, therefore, many employers would like access to an investment instrument with a yield which would adjust fully and immediately to changing rates of inflation. Unfortunately, the present financial system offers no such instrument. The market value of long-term bonds fluctuates inversely with interest rates. In periods of rising inflation, therefore, the market value of outstanding long-term bonds may be eroded both in nominal and real terms. Equities produce unstable rates of return and are no longer considered to provide an adequate short- and medium-term hedge against inflation. Residential mortgages offer more scope for yield adjustment since the periodic renewal clause has come into general use, but still may lag well behind changes in inflation rates and consequent changes in rates of interest. Short-term debt securities and money market instruments usually provide greater scope for yield adjustment, however, because their frequent rollovers do enable investors to reinvest the proceeds of maturing securities into others. There is no certainty, of course, about the real yield that will be earned on the proceeds that are reinvested. Indexed bonds, however, could further increase the ability of employers to invest in securities providing a rate of return which kept pace with inflation.

4. Indexed Securities and the Significance of Real Rates of Return. Under existing non-indexed pension plans providing benefits based on career average earnings - the relative importance of which has been declining - there may be a tendency to seek to maximize nominal rates of return because, all other things being equal, higher than anticipated money income on pension fund assets reduces the need for employer pension contributions. Those pension plans providing benefits based on so-called final average earnings, which have been gaining in importance are, of course, already effectively indexed until retirement. Nominal returns are, therefore, of lesser concern (and real returns of greater concern) for such plans. With full indexing, however, real, rather than nominal, rates of return would become the overriding concern for all plans because all liabilities (pre- and post-retirement) would be indexed. (Basically, the real rate would 'finance' the accumulation of assets necessary to produce a given level of real downstream pension benefits, while the 'inflationary premium' part of the nominal rate of return could be deemed to be funding the current dollar value of that level of downstream benefits.)

5. The Significance of Employer-Sponsored Pension Funds in Financial Markets. It may be useful to note briefly the significance of the flow of savings associated with employer-sponsored pension plans, and of the already existing stock of such savings, within the overall Canadian financial framework. If employer-sponsored pensions (particularly those in the private sector) were to be indexed, and indexed bonds made available to facilitate the indexing of those pensions, questions would arise as to what the demand for such bonds might be and what portion of Canadian financial markets and financial assets might become indexed for inflation. An examination of the total volume of assets involved, and of their current deployment as between various types of instruments, constitutes a necessary step towards determining the demand for indexed bonds and their possible effect on financial markets. While for a number of reasons the volume of pension fund assets will likely always be less than the volume of pension liabilities, the asset figure will nevertheless be useful in developing a first approximation of demand.

Table 2 sets out the distribution of assets accumulated in various private forms to 'fund' retirement incomes such as trusteed pension plans, the annuities and segregated funds activities of insurance companies, and Registered Retirement Savings Plans (RRSPs). These numbers specifically exclude the Canada and Quebec Pension Plans (C/QPP), Old Age Security (OAS) and Guaranteed Income Supplement (GIS), the public sector superannuation programs, and Government of Canada annuities. They do, however, include all public sector 'trusteed' plans.

Table 2

Estimated Assets of Trusteed Pension Plans, Other Employer-Sponsored Plans, and RRSPs, 1976

	Total Assets	Bonds	Stocks	Mortgages and Guaranteed Funds(1)	Misc.(2)	Annual Flow
			($ billions)			
Trusteed pension funds	25.2	12.2	5.8	4.3	2.9	3.7
Insurance Cos.						
a) annuities	4.6	1.7	0.3	1.9	0.7	0.4
b) segregated funds	2.2	0.6	0.8	0.6	0.2	0.4
RRSPs	7.5	1.3	1.1	4.5	0.6	1.7
Total	39.5	15.8	8.0	11.3	4.4	6.2

(1)Includes investment certificates, term deposits, etc., the proceeds of which are largely used by issuers to finance the acquisition of mortgages.

(2)Includes cash balances, money market instruments, real estate and foreign securities.

By comparison, the asset components of the total Canadian financial market are illustrated in Table 3.

Table 3

Relative Importance of Various Types of Assets in Canadian Financial Markets, 1973-1976

	End of Year Level	Annual Flow			
	1976	1973	1974	1975	1976
		($ billions)			
Treasury Bills & Short-Term Paper	17.1	1.2	3.7	1.2	2.5
Mortgages	81.5	7.9	8.3	8.6	12.4
Bonds(1)	111.7	3.9	7.8	12.2	15.9
Stocks	117.7	1.4	1.3	1.8	1.9
Total	328.0	14.4	21.1	23.8	31.7

(1)Net of Canada Savings Bonds.
Source: 1. Financial Flow Accounts as taken from CANSIM, June 1, 1978.
2. Statistics Canada, 13-002, Financial Flow Accounts.
3. Statistics Canada, 13-563, Financial Flow Accounts.

The importance of these private retirement financing arrangements relative to the Canadian financial structure taken as a whole can be gauged from comparisons of the 1976 cash flow of these private retirement income funds, at $6.2 billion, with overall savings flows of $31.7 billion in 1976 (amounting to 20%), and of the 1976 figure for retirement-related assets of $39.5 billion with the total asset figure of $328 billion (representing 12%). It can be further illustrated by the fact that the annual net cash flows of trusteed pension funds alone during the decade to December 31, 1974, in all but one year were equivalent to 22-26% of the total net new supply of Canada long-term financial instruments.

It is difficult to be specific about the offsetting liabilities of retirement income funds. By definition, total liabilities with respect to RRSPs and money purchase plans are identical to their assets. Insured plans also have few or no unfunded liabilities. As for segregated funds of insurance companies, no data are available. With regard to trusteed pension fund liabilities, however, a 1975 survey by the Ontario Pension Commission of a substantial sample of plans indicated that 68% of the plans surveyed, covering 84% of the surveyed plan membership, were under-funded by an average 32%. Most of this under-funding reflected 'initial prior service credits', retroactive amendments and updating, experience deficiencies arising from unexpectedly high salary increases in the case of final average pay plans, updated benefits in the case of flat benefit plans, and adjustments to pensions-in-pay generally.

Normally, smaller employers with less favourable pension plans tend to be more fully funded. These results do not appear out of line with the United States experience, insofar as the latter can be determined from information provided in new issue prospectuses filed with the Securities and Exchange Commission and from material published elsewhere.

Little is known about the disbursement patterns of pension plans involving the insurance companies and about the liquidation rates of RRSPs. With regard to trusteed pension funds, however, a reported net cash flow of $3.7 billion in 1976 reflected total contributions of $3.4 billion, plus $1.7 billion of investment income, less $1.1 billion in pensions paid out or purchased, and less a further $0.3 billion in other miscellaneous expenses - including cash withdrawals by beneficiaries.

In summary, private retirement arrangements constitute a significant portion of net new savings flows and of the total stock of financial assets in Canada. The future growth in private retirement-related assets could continue to outstrip the overall rate of asset growth as a result of a number of possible factors. These include a reduction in existing unamortized liabilities, an increase in the popularity of RRSPs as the average age of the population rises, and the possible increase in the future in the assets of private retirement funds. Still, there are offsetting factors and it is difficult to be certain.

B. Analysis

1. Choice of Scenarios. If the federal government were to urge - or require - private employers to index their pension plans, it may well be argued that such a policy stance would have to be augmented by some initiative on the part of the government to reduce the volatility and uncertainty of employer pension costs. The introduction of indexed federal bonds might constitute such an initiative. One question that arises, however, is whether a sufficient quantity of indexed bonds could, as a practical matter, be made available to meet the requirements of pension plans (including those administered by life insurance companies).

To answer this question, it is necessary to consider the framework within which indexed bonds might be introduced. The analysis below assumes that the federal government would take the initiative in issuing indexed bonds.(2) Three scenarios are considered:

Scenario 1: Government of Canada indexed bonds are available in unlimited quantities, but only to eligible purchasers in respect of pension and retirement saving programs.(3)

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(2)A report prepared for the Economic Council by James Pesando argues that, for reasons of cost, private companies are unlikely to take the lead in offering indexed bonds.

(3)While it may be that the federal government in this case could limit acquisition of its own indexed bonds to 'eligible purchasers' only, (i.e. to retirement income plans) other issuers of indexed bonds might not impose such restrictions.

Scenario 2: The volume of Government of Canada indexed bonds is limited, but there are no restrictions on who may purchase them.

Scenario 3: The volume of Government of Canada indexed bonds is limited and they are available only to eligible purchasers for pension-related purposes.

A fourth scenario, where Government of Canada indexed bonds would be available in unlimited quantities to all willing buyers, was examined, but discarded as being impractical. If the demand for, and the supply of, indexed federal bonds were open-ended, the federal government at some point would likely have to assume the role of a major financial intermediary, since the level of indexed bonds it would be expected to issue would, at times at least, be in excess of its own financing needs. (This is what happened in Brazil in 1974.)

Under Scenarios 2 and 3, where there is a limit on the quantity of federal indexed bonds issued, the question arises as to how the federal government would establish and allocate the available supply. One way of determining the total amount of new indexed bonds to be made available would be to limit it to a fraction of the total of net new cash requirements and rollovers of maturing bond issues, without any commitment to hold this ratio fixed over time. The total supply to be made available and its allocation might be determined simultaneously by offering new indexed bonds to prospective purchasers based on the historical pattern of their acquisition of assets. The latter would have the advantage of facilitating the forecasting by the government of the future demand for indexed bonds, and of helping to prevent sudden fluctuations in demand as economic conditions changed.

An alternative means of determining the distribution of a given volume of new indexed bonds, however arrived at, would be to allocate the total by auction based on bid prices. In any case, it might well be desirable to build into any allocation system a preference for small- and medium-size pension funds, while retaining the price mechanism as the basic determinant of who would get the bonds.

2. The Supply of and Demand for Indexed Bonds. To develop even a rough sense of what the demand might be for indexed bonds under each of these three scenarios necessarily involves considerable guesswork. A major uncertainty concerns the real interest return that should be established on an indexed bond. If the real return is significantly higher than many lenders believe they will likely be able to earn from conventional securities, after discounting the nominal rate of interest offered by the anticipated rate of future inflation, the resulting heavy demand for indexed bonds could have a disruptive effect on financial markets. In the reverse situation, however, the demand for indexed bonds may be minimal, with the result that they will fail to achieve their stated objective.(4)

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(4)To the extent that a viable secondary market develops for indexed federal bonds, the chances of this happening would be reduced.

Other questions relate to the number of buyers who would be willing to pay something extra to obtain an indexed bond in a period of more than normal uncertainty about future inflation, and to the number of buyers (e.g. some small pension funds) who would be willing to do so at all times, regardless of inflationary circumstances. For instance, it is not inconceivable that some buyers who would not normally accept less than an anticipated 2% real return annually on ordinary money bonds might, in fact, accept less than a 2% real return annually if that return were assured. Unfortunately, it is by no means clear how the certainty of real returns would be valued by various classes of buyers.

Thus, the demand for a given volume of indexed bonds at any point in time would be influenced heavily by the real rate of return that is guaranteed, and by the way that real rate compares to the anticipated real rate on money bonds in light of inflationary expectations. On the assumption that the real rate and the price would be appropriate to market circumstances, a very crude approximation of demand and supply can be developed.(5)

In Scenarios 1 and 3, eligible holders of indexed federal bonds are limited to institutions administering pension and retirement saving programs - namely, trusteed pension funds, insurance companies with respect to their annuity and segregated fund operations, and all financial intermediaries with respect to RRSPs. The total asset base and the annual cash flow of these sectors of the financial markets was approximately $39.5 billion and $6.2 billion respectively in 1976. These numbers set the outer limit for the potential demand for indexed bonds in that year. In practice, however, total demand would have been a good deal smaller for the following reasons: a) pension fund managers would be unlikely to commit themselves unreservedly to such a new instrument; b) a continuing desire to achieve the perceived benefits of investment diversification; c) institutional inertia, as some investment managers would resist any wholesale move into indexed securities for reasons of their own survival (although in most cases they could be overruled by the plans' sponsors); and d) any widespread liquidation of non-indexed assets to purchase indexed bonds could cause an erosion in the market value of the former which would increase the cost of making such a switch to the point of being prohibitive.

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(5)An attempt has been made in Annex A to quantify the potential demand for, and supply of, indexed bonds. In the absence of any price structure within which the supply and demand situation might evolve, its findings are, of course, tentative in the extreme.

The analysis in Annex A suggests that potential demand under Scenario 1 might be in the $5 billion range annually for a period of several years, with great uncertainty as to whether the demand might subsequently drop, remain constant, or rise. The factors that bear on demand are so numerous, and so contradictory, that it is difficult to make any judgment as to what the outcome would be.

Under Scenario 3, although potential demand would be similar to Scenario 1, the limited supply under some allocation procedures could result in a lower real return as compared to Scenario 1 and, hence, serve to cut down the total effective demand. Under Scenario 2, assuming the same supply of indexed bonds as in Scenario 3, the real return required to place those bonds could be even lower than in Scenario 1, since potential demand would be greater at all price levels.

On the supply side, Scenario 1 guarantees that the supply will meet the demand at the real rate of return chosen. Scenarios 2 and 3 are based on a limited supply, and the inference is that there are other government objectives that must be considered, and that these necessarily constrain the potential supply. Some of these other objectives are discussed below. Here it is sufficient to note that the analysis in Annex A suggests that perhaps $3 billion annually might be made available in indexed bonds by federal and provincial governments in the several years ahead if this approach were adopted. This would be about two-thirds of the estimated potential demand. On a longer term basis, however, the potential supply from governments would likely drop to half the potential demand, or less, as government cash requirements declined.

As noted previously, there would be nothing to prevent the federal government from limiting the sale of its indexed bonds to institutions financing indexed pensions. However, the federal government would not be able to impose the same constraints on other issuers. It would be up to the latter to decide for themselves if the sale of their indexed bonds would be limited in this, or any other, way.

What about sources of supply for indexed bonds other than the federal and provincial governments? Municipalities have a revenue base which is less elastic relative to inflation than the federal or provincial governments. Hence, they would likely feel less able to issue indexed bonds than the provinces. In any event, pension funds are at present a less significant source of financing for municipalities than for the provinces and, accordingly, municipalities may feel less compelled to offer indexed bonds to protect an established financing source.

It is also doubtful that, in the first instance at least, the corporate sector would be a major source of indexed bonds. For one thing, corporations that issue indexed bonds would face substantial uncertainties. For instance, even if initial debt servicing costs were lower for indexed bonds than for money bonds, the differential might not be considered sufficient to offset the apparently open-ended nature of the borrower's debt servicing liability during the life of the issue. Secondly, to the extent that indexed bonds would be a new and

untried instrument, they might well involve the borrower in additional marketing and advertising costs, which would further reduce the advantage in initial borrowing costs that indexed bonds might have over money bonds. Finally, assuming that indexed bonds would be geared to some general index, such as the Consumer Price Index (CPI), future debt servicing costs need not conform with the specific future cost and profit patterns of individual borrowers. Even if the proceeds of an indexed issue were invested in generally 'inflation-proof' assets such as real estate, the fact that the value of these assets might keep pace with inflation over the long haul would not eliminate corporate concern about its ability to meet current debt servicing costs during the short and medium term.

On the other hand, it should be noted that some corporations are already accepting what is clearly equivalent to the servicing costs of 'indexed debt'. Some large corporations, for example, depend on short-term 'commercial paper' as a source of financing. Others use revolving lines of bank credit. Still others in recent years have obtained term financing from banks on a 'prime rate plus' basis. In each of these instances, future debt servicing costs will fluctuate with the interest rate structure and will not be predictable with precision. To the extent that indexed bonds would replace such financing, corporate exposure to risk from unforeseen future debt service cost fluctuations would not be much different than it would be under existing circumstances. Still, a long-term indexed bond issue would commit the corporate borrower to more unpredictable debt servicing costs over longer periods of time.

Furthermore, the degree of acceptance by corporations of indexed bonds as a financing instrument is likely to vary from one corporation to another. To the extent that corporations could readily 'lay off' the risk of future debt service cost fluctuations onto someone else, their attitude towards indexed bonds would likely be less negative. Monopolies, or near monopolies - whose market power enabled them to pass on to their customers cost increases, including debt servicing costs - might have fewer reservations about indexed bonds than companies in more competitive environments. To the extent that firms in regulated industries could incorporate anticipated increases in future debt servicing costs into their expenditure base for the purpose of justifying rate increases, they might also be relatively less concerned about the fluctuating debt service cost aspects of indexed bonds. Finally, financial intermediaries which could match indexed liabilities with indexed assets could, all other things being equal, be expected to be in a favourable position to issue indexed bonds.(6)

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(6)In the final analysis, and in the context of the feasibility of indexing pensions, it may well be that the same considerations of market power and financial strength that would enable a corporation to consider issuing indexed bonds are also pre-requisites for the feasibility of the indexing of the corporate pension plan. That is, corporations that already offer a substantial measure of pension indexing would also be those most likely to issue indexed bonds.

In summary, because federal and provincial governments would appear unlikely to meet the initial demand for indexed bonds, and corporations would probably not be in the field at first, it appears almost inevitable that the supply of indexed federal and provincial bonds would need to be subject - at least at the outset - to some form of restraint, with the result that there would be some, perhaps substantial, unsatisfied demand.(7) These conclusions, it bears repeating, are based on very rough estimates only. Furthermore, governments might find themselves in future unable to issue as many indexed bonds as may be practical simply because of limits on their cash requirements. And while some corporations might have begun by then to issue such bonds, demand may also have risen. Therefore, with the passage of time, the allocation problem may remain difficult. There are, however, too many variables at this stage to speak with any certainty.

3. The General Economic Impact. Indexed bonds may have an effect on the efficiency and stability of the economic system because they eliminate the transfers of real wealth between borrowers and lenders that occur with money bonds when the actual inflation rate differs from the anticipated rate. There is no consensus as to the nature or likely importance of these effects. Some advocate the use of indexed bonds as having potentially beneficial effects on the functioning of the economy; others see substantial dangers to the economy from the use of indexed financial instruments.

This section provides a brief discussion of the effects that the existence of indexed bonds might have on saving, investment, economic stability, and investor psychology. Unfortunately, key links in the analysis are subject to considerable uncertainty. One uncertainty concerns the role that indexed assets would come to play in financial markets and, in particular, the extent to which they would be issued by borrowers other than the federal government. The financial market might adjust readily to a limited issue of indexed federal bonds (and to offsetting reductions in the issue of other types of securities

(7)Even with unsatisfied demand, there is a risk with Scenarios 1 or 3 that the issue price of indexed bonds would be below the price that would prevail if there were no restrictions on buyers. If the price paid by pension funds were lower than it would be in the absence of restrictions, this would imply a subsidy to them. This could occur if market expectations about inflation exceeded the government's inflationary expectations. In that case, the market would bid up the price of the indexed bond, thus implying that the real interest coupon on the indexed bond was higher than it need have been.

by the federal government) through some switching in financial flows. If this were to occur, the use of indexed assets in the capital markets might remain modest. This is most likely in Scenario 3 and, under these circumstances, any general economic effect would be quite limited. Alternatively, if the federal government were to issue substantial quantities of indexed bonds and not restrict their holding (Scenario 2), or if it were to issue unlimited quantities to pension funds and life insurance companies in respect of their pension and annuity liabilities (Scenario 1), there might well be a general shift to indexed securities which could have a significant economic impact.

a) Effect on Savings. The availability of indexed bonds would offer savers increased certainty as to the real rate of return they would be able to obtain on their savings over specific periods of time. While this might be counted as a benefit in itself, it is by no means clear what effect it would have on the total level of savings. For some people it might make saving more attractive; others might feel they would need to save less, since they would no longer have to protect themselves against the contingency of a major reduction in their real wealth due to unanticipated inflation at some point in the future. It is also unclear whether the availability of indexed bonds would result in savers expecting higher or lower real returns. It would not be unreasonable to expect that, because of the removal of the inflation risk, somewhat lower real rates of return on indexed bonds would be acceptable to many lenders than the real return that they might in practice be able to earn on securities denominated in money terms. However, this could not be taken for granted.

If unanticipated inflation did occur, the existence of indexed assets would mean that wealth would not be redistributed from the personal sector (net asset holders) to net debtors (the corporate sector and governments), which is what occurs when only money bonds are available. Again, however, there is no very strong presumption as to the direction of the net effect on savings of such a redistribution of wealth.(8) One might conclude, therefore, that whatever the direction of the effect, indexation is unlikely to cause a major change in net savings in the economy.

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(8)Widespread adoption of indexed principal financial instruments, however, would cause a significant change in the appearance of the composition of savings as depicted in the National Accounts. Basically, the 'inflation component' of nominal interest, which is now recorded in different parts of the ledger as part of personal (interest) income, part of government expenditure, part of business expenses, and - to the extent it is reinvested - as part of personal savings, would be eliminated.

But the effect of indexation on the composition of savings appears to be more predictable and perhaps more significant. The availability of indexed bonds could be expected to reduce the relative attractiveness of assets such as consumer durables, objets d'art, inventories and real estate which have acquired a growing appeal in recent years as hedges against inflation. As a result, everything else being equal, the availability of indexed bonds would mean that a greater proportion of savings would be available for investment in financial assets; in particular, one would expect a greater willingness to channel savings into long-term debt instruments.

b) Effect on Investment. Indexed bonds could have some favourable and some unfavourable effects on the allocation of investment. On the favourable side, the issuance of indexed bonds by corporations, if it were to come about, would likely reduce two tendencies towards distortion in the allocation of business investment which otherwise exist when either the inflationary outlook is uncertain and/or when a high continuing rate of inflation and high nominal interest rates prevail. Firstly, in the absence of indexed instruments, expectations about inflation forecasts might be expected to have a significant influence on a firm's willingness to invest, particularly in longer-term projects, when a substantial part of the investment must be financed through borrowing. Everything else being equal, the higher the rate of inflation a firm expects, the more likely it is to judge a project to be profitable when financed through issuing debt at a given nominal interest rate. There is little reason to expect different firms' expectations about future rates of inflation to be correlated with the inherent real returns on their investment projects. Thus, in the absence of indexation, diverse expectations about future rates of inflation will introduce an extraneous factor (individual firms' expectations about inflation) into the allocation of investment. The use of indexed bonds as a financing medium by corporations would tend to reduce this extraneous factor. In particular, the possibility of borrowing via indexed bonds might encourage investment on the part of those with low inflationary expectations, i.e. those who look upon current interest rates as incorporating a high real interest cost.

Indexed bonds might also alter the effect of inflation on the allocation of investment in a second way. In the absence of indexed bonds, the combination of a shift to higher levels of inflation and higher levels of nominal interest rates changes the time pattern of real debt service payments on a bond or mortgage. With inflation, real debt service payments in respect of repayment obligations with a fixed money interest rate are relatively high early in the life of the debt, and decline towards the end of the repayment period as the principal sum is amortized. The longer the life of the asset and the higher the rate of inflation, the stronger this effect will be. This basic point may be illustrated further with reference to a conventional mortgage where the debt service payments - interest plus principal amortization - are constant in current dollars over the life of the mortgage. Obviously, with inflation, a constant stream of payments in current dollars will have a value in real terms which declines (and the more rapidly so the higher the rate of inflation). If two payments streams under different

rates of inflation are to have the same present values - as is the case if nominal interest rates adjust fully for inflation - the one that declines faster in real terms (the higher inflation case) must start at higher levels in real (and nominal) terms and end at a lower level in real terms. Also, since a longer maturity implies a greater decline from start to finish in the value of the real payments stream for any given rate of inflation, the longer the maturity, the larger will be the initial shift up (and the larger the shift down at maturity).

Without indexed bonds, the 'tilting effect' of this time profile of real debt services charges(9) means that a shift to higher levels of inflation will result in more severe initial cash flow problems for long-lived investment projects than for shorter-lived projects. Some relative discouragement of long-lived projects under the existing system might thus be expected. In other words, firms, confronted with the choice of two projects having the same expected real rate of return over their lifetimes, will choose the shorter-lived project in order to avoid the higher risks associated with the longer-lived project during the initial period of reduced relative cash flow. An indexed loan, however, would have a constant debt service stream in real terms.

It can thus be argued that if the corporate sector were to follow the government's example in selling indexed bonds, the use of the indexed bonds by corporate borrowers would tend to avoid two potentially distorting effects on the allocation of corporate investment which otherwise tend to occur under inflationary conditions. But it is not possible to determine the quantitative significance of these distortions.

On the other hand, the introduction of indexed bonds (by the federal government) could also have some adverse effects on private borrowers and private investment. If some borrowers were to issue indexed bonds, it might well become more difficult for others to raise funds on an unindexed basis. If that were to be the case, this might have the effect of raising interest rates on unindexed debt and discouraging private investment. However, this need not be the case. If governments only substituted indexed debt for some of the non-indexed debt they would otherwise have issued, there need not necessarily be any effect on the nominal interest rate which those wishing to borrow on an unindexed basis would need to pay. But even in this case, as the great majority of private borrowers would be reluctant to issue debt on an indexed basis, many private borrowers would believe themselves to be at a disadvantage in raising funds in the market relative to governments. The psychological effect alone might discourage these private borrowers from undertaking investment.

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(9)While the tilting effect is fully eliminated in the case of indexed principal bonds, since both interest payments and the redemption value are constant in real terms, it is less adequately dealt with in the case of principal compensation bonds. In the case of the latter, the bonds' current value will decline in real terms in an inflationary environment and, hence, the debt servicing schedule still contains a front-end load element.

Mortgage borrowers might be thought to be among those placed at a disadvantage if indexed debt became available from governments. But because of the generally long amortization periods associated with mortgages, mortgage borrowers are particularly vulnerable to the tilting of real payment streams under inflationary conditions already discussed. As a result, the indexation of mortgages could provide benefits to mortgage borrowers by reducing the initial real debt servicing cost burden.

c) Effect on Expectations and Other Economic Effects. Extension of indexing to federal government bonds might be taken as a further indication that the government viewed the problem of inflation as insoluble. The Organization for Economic Cooperation and Development (OECD) put the traditional case against indexed government bonds on expectational grounds most strongly in a 1973 report entitled Indexation of Fixed Income Securities. It stated that "a concern of governments must be to guard against the risks that recourse to indexation would be interpreted by public opinion as a sign that the authorities were less firm in their determination to bring inflation under control and that a widespread adoption of indexing would fuel inflation expectations". In recent years, however, the high rates of inflation experienced have increased somewhat the importance of the equity objectives achieved through indexing relative to the concerns that exist about its expectational impact. A group of independent experts chaired by Paul McCracken presented a report to the OECD in 1977 in which they commented rather favourably on the indexation of financial assets, even though they continued to express reservations about the desirability of wage indexation and escalators in price contracts.

Indexing financial instruments would also have certain broad economic effects which parallel those resulting from the indexation of taxes, social security payments or wages. It would tend to reduce one source of 'automatic stabilization' in the economy to variations in demand-related inflation. For instance, at present, an increase in inflation causes a decline in real wealth and, thus, presumably a decline in real consumer spending. This reduction in real demand will tend to brake the increase in inflation, if it has its origins in excess demand. To the extent that a growing portion of total wealth would be held in the form of indexed bonds, the real value of which would not be affected by inflation, this stabilizing wealth effect on consumer spending would tend to diminish.

To the extent that business relied on indexed debt instruments for financing, and to the extent that it was able to raise prices as costs rose, any increase in the rate of inflation would raise the debt servicing component of total operating costs and, thus, put further upward pressure on prices. Indexing could then become a potential source of cost-push inflationary pressure. This would be particularly troublesome when the inflation triggering the indexing resulted from a depreciation of the currency necessary to restore equilibrium in the current account of the balance of payments, as has been the situation in Canada in recent years. In that case, indexing would temper the ensuing change in relative prices and impede the process of adjustment. In 1967, following the devaluation of the markka, the Finnish government eliminated much of the indexing in its economy for that very reason.

On the other hand, by reducing the shifts in the distribution of wealth and income between borrowers and lenders which result from unexpected inflation, and by reducing any changes in the composition of demand which these income shifts entail, the indexing of financial instruments might well reduce one possible source of disturbance in the economy. Under the existing system, a demand management policy that is successful in reducing inflation tends to leave some borrowers stranded with previous high nominal interest rate commitments, which may create financial difficulties for those borrowers. The use of indexed bonds could lessen the financial difficulties corporate borrowers might encounter during the transition from high to low rates of inflation and thereby facilitate the implementation and acceptance of anti-inflationary monetary and fiscal policies.

In summary, from the point of view of its effects on economic stability, there is a great deal of uncertainty as to the direction of the effect of indexation. It might impede adjustment if the economy experienced a shock to prices that was not created by excessive demand but by other causes such as a sharp increase in the cost of imported oil. At the same time, however, it might facilitate adjustment to lower rates of inflation achieved through conventional demand management methods. As was the case with savings and investment, the impact of indexing on economic stability would likely be least significant under Scenario 3.

4. <u>The Implications for Financial Markets</u>. A key to the implications for the financial markets of the issuance of the Government of Canada indexed bonds relates to the effect they might have in inducing other borrowers to follow suit. The experience of other countries has shown that the introduction of indexed securities by a leading borrower does have some effect on other borrowers' willingness to market indexed securities.

The impact of the issuance of indexed federal bonds on the financial system can be analyzed in terms of their effect on lenders and borrowers and would depend, to a large extent, on the proportion of overall demand for this type of security. If demand were large, exceeding that required for retirement income funding purposes, many debt issuers might eventually feel obliged to resort to this type of financing. This would likely lead to a greater variety of indexed investment instruments being developed so as to enable borrowers to remain competitive and the needs of lenders to be met.

The relative attractiveness of indexed securities depends not only on the market's forecast with respect to inflation and real interest rates, but also on the degree of confidence the market has in this outlook. The choice the market faces is whether there is greater risk in its outlook on real interest rates or its outlook on inflation; another uncertainty relates to the volatility of possible changes in these outlooks. When the market has little confidence in its inflationary outlook, changes in which can be quite volatile, it would prefer an indexed bond to minimize the risk related to this uncertainty. Consequently, the case can be made that, for reasons of risk minimization, there will

always be some demand for indexed bonds. This demand would exist even in the absence of expectations of high and rising inflation rates and would be a function of the degree of uncertainty borrowers attached to their anticipated rate of inflation and to the volatility of that rate vis-à-vis anticipated real interest rates.

On the assumption that there would likely be a substantial demand for indexed bonds, a key determinant of the impact on financial markets of the introduction of indexed bonds is obviously the extent to which they might be issued by borrowers other than the federal government. As noted earlier, however, it is uncertain what the reaction of other borrowers might be. The issuance of indexed bonds by the federal government could result in pension funds seeking to purchase more indexed federal bonds and fewer bonds of other borrowers. While such switching of financial flows could put pressure on other borrowers to compete through indexation of their own securities, this need not be the case, provided the government did not increase the overall demands on the market beyond that which would otherwise exist. In the former case, the increased purchase of indexed federal bonds by pension funds would mean that fewer federal bonds would need to be sold elsewhere. This, in turn, would leave funds available from lenders for those borrowers who had previously depended heavily on financing from pension funds. It is, thus, conceivable that the financial market adjustment to the issuance of indexed federal bonds could be limited to some switching in financial flows, without any overwhelming pressure for more widespread indexation of bonds by other issuers. On the other hand, the federal example with respect to the indexing of its bonds could induce a general shift towards indexation, in which case there would likely be less switching of capital flows. The indexation of securities would tend to spread, however, if borrowers who previously had depended heavily on pension funds as a major source of long-term financing found that it was necessary to issue indexed bonds of their own in order to attract the funds they required from other sources or, indeed, to compete for a share of funds from retirement savings.

Under Scenario 1 (unlimited quantities of indexed federal bonds for eligible purchasers), the indexing of bonds would be most likely to spread to other issuers either because the latter sought to protect their traditional financing sources or because they found that an indexed bond feature was essential to the development of alternate sources of long-term financing. Under Scenario 2 (limited quantities of indexed federal bonds to all comers), the risk of the spread of indexation might be somewhat lower in the first instance because there might not be the same pressure on borrowers to protect traditional funding sources. On the other hand - depending on investors' experience with indexed bonds - there might eventually develop greater pressure for more, and more widespread, indexing of all bonds. Under Scenario 3 (limited quantities of indexed federal bonds to be available only to eligible purchasers), the risk of the spread of indexing is likely to be smallest and might well be a function of the extent of the limit on the supply of indexed federal bonds: the fewer issued, the less likely indexing would be to spread.

5. The Impact on Government Operations.

a) Effect on the Conduct of Monetary Policy. The introduction of indexed bonds would influence the structure of the bond market - that is, the types and amounts of securities available - and the nature of those who issued and purchased securities. The extent to which the market structure changed would have considerable implications for the conduct of monetary policy because of the importance of open market operations (the buying and selling of federal securities) by the Bank of Canada as a means of implementing monetary policy. The success with which open market operations is conducted depends heavily on the nature of that capital market.

From this perspective stems one argument against the unrestricted Scenario 1. This is the need to retain flexibility in the type of instrument available for trading in the market. The implementation of an effective monetary policy could be hampered if ownership of federal securities were unduly concentrated, particularly if it were concentrated in less actively traded accounts. If indexed federal government bonds were freely available to the pension system and if the private sector did not issue indexed securities on a significant scale, a substantial volume of pension funds might switch into federal government debt. Over time, pension funds could end up holding a large proportion of federal debt outstanding. In that case, the breadth and depth required in the market to absorb large transactions in federal bonds without causing excessive fluctuations in interest rates might be reduced. In this context, Scenarios 2 and 3, with their implied restraints on the supply of indexed bonds, would be easier from the point of view of the implementation of monetary policy.

The Bank of Canada normally purchases some portion of new government debt issues for purposes of managing the money supply. If pension funds were allowed to acquire any amount of indexed federal debt they wished, they might not only force the federal government into the role of a financial intermediary in years when pension funds' demand for such debt was in excess of the amount needed to finance government operations, but they could also interfere with the central bank's management of the money supply.

On the other hand, there are some observers who feel that the effectiveness of monetary policy might be enhanced by the existence of parallel markets for both indexed and non-indexed bonds. In their view, the monetary authorities, by operating in both segments of the market simultaneously, would be able to influence real interest rates as well as nominal interest rates, and would be able to provide clearer

signals to market participants.(10) Under Scenario 3, however, there would likely be a very thin market for indexed bonds, and very little trading; the potential for using indexed bonds as a monetary policy tool, as outlined here, would then be very small.

In summary, it is difficult to be precise about the impact of the introduction of indexed bonds on the effectiveness of open market operations, and hence on monetary policy, as it has traditionally been implemented. It can be assumed, however, that except under Scenario 2, difficulties might arise for implementing monetary policy because of a likely reduction of the depth and diversity of the market for government securities. Parallel markets for indexed and non-indexed bonds, however, would not in themselves inhibit the government from implementing effective policy. They might even be helpful.

b) Effect on Public Debt Charges. Two sorts of questions may be raised about the implications of indexed bonds for the cost of public debt charges to the government:

a) how might one expect the interest costs of such bonds to compare, on average, with those of conventional bonds? and

b) what are the risks of significant budgetary problems if the actual costs turn out very differently from expected costs (because inflation turns out differently from expectations at the time the bonds were issued)?

With regard to the cost of borrowing through indexed bonds, a theoretical case can be made that the expected cost to the government should be lower for indexed than money bonds. This assumes that bond buyers would be willing to accept a lower real rate of interest than the real rate which they expect on a money bond, in return for the elimination of the 'inflation risk'. Of course, if both investors and governments under-estimated future rates of inflation, as they appear to have done fairly consistently during the last two decades, the cost to

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(10)For instance, in a market confined to the trading of money bonds, an increase in interest rates resulting from open market sales might be misinterpreted as reflecting an increase in inflationary expectations. Hence, it could fail to curtail the rate of growth in spending. In contrast, an increase in the real cost of borrowing caused by open market sales of indexed bonds would be less likely to be misinterpreted and more likely to reduce all types of spending, including investment. Furthermore, a sale of indexed bonds would tend to compress the yield differential between money and indexed bonds, would lower one possible indicator of inflationary expectations and could possibly have a psychological impact on inflationary expectations. Alternatively, the money authorities could attempt to reduce this differential, and lower inflationary expectations, by selling indexed bonds and buying money bonds, leaving the overall stance of monetary policy unchanged.

the government of using indexed bonds would be higher than the cost of using money bonds (since the actual cost of the money bond in real terms would turn out to be lower than the real rate interest coupon on the indexed bonds likely would have been). The reverse could also occur; if the government had greater confidence than the public in its ability to reduce the rate of inflation over time, the use of indexed bonds would appear very attractive from an expected cost point of view. Annex B seeks to quantify the magnitude of the possible cost fluctuations and to measure the risks involved.

On balance, however, it could well be wrong to assume that the use of indexed bonds would lead to significant savings to the government on average public debt charges over any extended period of time. For such an assumption to be realized, a high degree of success in forecasting inflation would be required, and the experience of recent years raises questions about such an outcome. Use of indexed bonds would also increase the margin of uncertainty surrounding short-run forecasts of the dollar value of public debt payments, though this margin would still be relatively small in the case of the 'indexed principal' form of indexed bonds (where the compensation for the loss of real value is delayed until maturity, i.e. until some point well into the future).(11) In general, the use of indexed principal bonds could be expected to increase the stability of public debt payments marginally in terms of Gross National Product (GNP), whereas if the principal compensation form of bond were used, stability in terms of GNP would decrease. Thus, if the government wished to maintain a relatively stable ratio of public debt charges to GNP, use of indexed principal bonds would be preferable to principal compensation bonds.

c) Implications for Tax Policy. Before considering the implications for tax policy, some clear limits must be placed on this aspect of the issue of indexed bonds.

Firstly, there are direct implications for tax policy only if taxable entities are involved. Since neither registered pension funds nor the government are taxable, any system of bond indexing involving only these institutions is not directly relevant for tax policy. This means that the following discussion is largely limited to Scenario 2, where some of the indexed bonds are held outside pension funds, and to circumstances where taxable corporations issue indexed instruments.

Secondly, even under Scenario 2, there are direct implications for tax policy only if special tax treatment is accorded to the inflation component of interest payments on the indexed bonds. Under Scenario 2, the government issues specific quantities of indexed bonds to the public at large. At present, with unindexed bonds, bond holders are not indifferent to the existence of inflation. Inflation increases nominal

(11)This is the case on a cash basis only.

rates of interest, but with progressive taxation, increases taxes proportionately more. The interaction of inflation and taxation has the effect of reducing the real income that bond holders would have earned from their investment in a non-inflationary environment, since tax is also paid on the inflationary portion of interest.

Under a system of indexed bonds, taxation of the inflationary element of the investment return would be highly visible and would likely generate criticism. But the exemption from taxation of the explicitly inflationary component of interest payments on indexed bonds would also generate demands to exempt the implicitly inflationary component of interest payments on non-indexed bonds. In turn, this would raise wider questions about the way the entire income tax system handles inflation. Until such time as the structure of the tax system can be altered in a fundamental way to handle inflationary situations more fairly, tax policy considerations may be viewed as a substantial argument against Scenario 2.

There is one further fact to consider. If indexed federal bonds were sold under Scenario 2 and a special exemption provided for the inflationary component of the interest income, that exemption would make the bonds of greater value to taxable entities than to non-taxable entities. In that case, pension funds might have trouble acquiring them in competition with other taxable investors. In any case, with taxable entities bidding for them, real returns might decline, making them of less interest to pension funds.

6. Other Countries' Experience with Indexed Bonds. Indexation of financial assets has been tried at one time or another in a number of countries, including Finland, Israel, Sweden, Norway, France, Austria, Ireland, the United Kingdom, Brazil and Argentina. However, in only a few countries did the volume of indexed bonds outstanding at any one time ever reach a high proportion of the total volume of securities outstanding.

In Finland, the indexing of long-term bonds was initiated immediately after World War II to avoid criticism from those who were being paid off in bonds for war-induced damage and losses. The index used was linked to wholesale prices. Initially, indexed bonds were issued only by the government, but over time financial institutions also became major issuers. Gradually indexing also spread to pensions and life insurance policies. During the late 1960s, indexing was abolished for everything but pensions and life insurance policies following an exchange crisis and currency devaluation. The government feared that the rapidly rising import prices would create an inflationary spiral via the various index linkages which would offset the benefits intended by the currency devaluation.

In Israel, the concept of indexed bonds was introduced in 1948 (using an exchange rate index) and was applied to government bonds in 1957. Since 1957, indexation has spread to many other economic and financial activities and transactions.

During the 1950s, when high rates of inflation prevailed in France, indexed instruments were popular and both public and private sector borrowers used them so extensively that up to one-half of the total new bond volume was of an indexed nature. The indexing bases used varied widely and related to prices, productivity, gold, and stock exchange prices, to mention only a few. Early in the Fifth Republic (1958), indexation was outlawed.

In Brazil, indexation was introduced in 1964 amidst conditions of runaway inflation. Ten years later, in 1974, government issuance of indexed bonds had to be temporarily suspended as accelerating inflation induced a wholesale shift towards indexed government bonds which threatened to dislocate the entire financial system. The index used in Brazil can be, and has been, altered from time to time so as to produce 'appropriate' results. Outside the government bond sector, indexing is of significance only in the area of housing finance.

The experience of other countries with respect to the indexing of bonds may not be directly applicable to Canada. Most other countries which have used indexed securities have a greater measure of government control over interest rates and the allocation of credit than does Canada. Their experience may, therefore, be of limited relevance to the relatively unrestricted, sophisticated and competitive North American financial markets.

Nevertheless, foreign experience suggests that:

- indexing can be, and has been, tied to many bases;
- parallel markets for indexed and non-indexed securities can exist side by side;
- the possibility of a proliferation of indexation does exist. In Finland and Israel, indexing spread to bonds issued by almost every type of borrower, to bank deposits and bank loans, to pension and insurance benefits, and to many other types of financial assets as well as to wages and salaries;
- indexing of financial instruments is not a panacea. An indexed system can produce undesirable feedbacks, particularly in countries which have a relatively open economy, where export prices can get out of line through the interaction of internal index-linkages; and
- on balance, the failure of indexed bonds to spread, or to maintain themselves where they were introduced, may well be indicative of their limitations as a policy instrument.

C. Summary and Conclusions

1. Summary.

a) Unanticipated inflation has a strong adverse impact on the financing arrangements underlying defined benefit pension plans, even in their present largely non-indexed form, because of its disparate impact on

pension fund assets and liabilities. The introduction of indexed bonds has been suggested in some quarters as a means of helping to ensure that the current return on pension fund assets would more adequately reflect the current inflationary experience.

b) The funding of retirement income constitutes a major source of new private financing in Canada's financial markets. By the end of 1976, total assets accumulated in this manner amounted to $39.5 billion, i.e. 12% of the total financial assets in Canada, while the $6.2 billion annual cash flow amounted to 20% of the total flow of savings in that same year.

c) A federal initiative to issue indexed federal bonds might well be required as a quid pro quo if private employers were to be persuaded to index their pension plans, or if, in conjunction with the provinces, indexed pension plans were to be legislated.

d) Three separate scenarios were identified involving the volume of indexed bonds issued by the federal government and the restrictions placed on the identity of the holders of such bonds. It appeared that the broad effect of the introduction of indexed bonds would be quite different under each approach, although with a considerable degree of uncertainty as to detailed effects.

e) A great deal of uncertainty surrounds any analysis of the economic impact of the introduction of indexed bonds. The effect on total savings would likely be fairly insignificant. The introduction of indexed bonds could have some impact on the ability of the economy to adapt to changing circumstances (i.e. on its built-in stabilizing capability). It could add to cost-push inflation by making possible a more rapid transmittal of price increases through the economy. It could also increase demand-pull types of inflation because indexed bonds would eliminate the transfers of wealth from lenders to borrowers which currently tend to reduce the purchasing power of savers in an inflationary environment. If corporations were to issue indexed bonds, the potential exists for some favourable effects on the allocation of corporate investment. On the other hand, if corporations did not issue indexed bonds, they might become less competitive in the long-term bond market, in which case the future growth of the economy could be impaired.

f) The effect of the introduction of indexed bonds on Canadian capital markets is also far from certain. In other countries where indexed bonds have been experimented with, they appear to have failed, by and large, to achieve a permanent place in the overall capital market structure.

g) The effect on government operations is only marginally clearer than the effect on the economy. The impact on government debt servicing costs would likely be small. While in theory it should be cheaper to borrow through indexed bonds because of the removal of the inflationary risk premium which is now part of the overall returns required by lenders, in practice the opposite might well be true if future inflation continued

to be under-estimated. The effect on the market for government securities, and hence on the implementation of monetary policy, under Scenarios 1 and 3, would not be favourable, while Scenario 2 raises problems of tax policy.

h) The current demand for indexed bonds by retirement income funds alone could be in the range of $5 billion annually during an initial five-year period. The main source of indexed bonds would almost inevitably have to be the federal and provincial governments, which might be able to divert, within their current borrowing programs, as much as $3 billion to indexed bonds, an amount that could be easily absorbed by the market with appropriate pricing. The several years ahead are perhaps an ideal time to introduce indexed bonds because the cash requirements of the federal government appear likely to be abnormally high by historical standards.

i) Finally, it must be noted that although the overall analysis suggests that from a broad economic and financial perspective indexed bonds might have as many advantages as disadvantages, the analysis is very tentative. There appears to be a good deal of scope for things to go wrong, the risk of which needs to be balanced against the various alternatives facing the government relating to retirement income policy.

2. Conclusions.

a) Indexed federal bonds by themselves should not be expected to make possible the indexing of the private pension system; the amount of bonds that would likely be required would be too large for the federal government alone or in conjunction with the provinces, to supply. They could, however, perhaps be of some use in any package of measures designed to enhance the feasibility of indexed private pension plans.

b) Of the three possible scenarios identified, Scenario 1, which assumes that unlimited amounts of indexed federal bonds would be issued to all those who wanted them for retirement income funding purposes, would be best suited to the needs of pension funds. However, it might require the federal government to act as a major financial intermediary; it might also interfere with the conduct of monetary policy by narrowing the market for Government of Canada securities. Because of this, and because of its likely unsettling effect on the Canadian capital markets, it would have to be rejected.

c) Scenario 2, which limits the volume of indexed federal bonds to be issued, but places no restrictions on who might hold them, would be less effective in helping pension funds to index. Pension funds would face competition for the acquisition of a smaller volume of indexed bonds than under Scenario 1, particularly if the tax system were changed to provide more equitable treatment for purely inflationary returns. Therefore, Scenario 2 is not likely to be effective.

d) Scenario 3, which limits both the supply of indexed federal bonds and the right to hold indexed federal bonds, would be more useful to pension funds than Scenario 2. Any meaningful restriction on the supply, however, might drive up the price of indexed bonds and reduce their real returns. Such a scenario would thus have some value - but only limited value - in helping to persuade the private sector to accept an indexed pension system.

e) If other bond issuers were involved in the issuance of indexed bonds, there would be some advantages. The issuers would share the burden of risk of greater than expected interest payments. Any increase in the supply and the diversity of indexed bonds available might help to better meet the needs of pension funds. On the other hand, a loss of control by the federal government as to who might hold indexed bonds, would likely cause holdings to spread beyond the pension funds, and thus would bring the difficulties associated with taxation front and centre. Unfortunately, if only for technical reasons, these tax difficulties are not easily solved. There would still be no assurance that the total supply of indexed bonds would be anywhere close to what pension funds might need, unless the federal government were prepared to accept, regardless of its own financing requirements, a role as the supplier of last resort of indexed securities.

f) Therefore, since under any of the three scenarios identified the advantages of issuing indexed federal bonds appear to be offset by the disadvantages of doing so, it is doubtful that a federal initiative to issue indexed bonds could by itself be expected to solve the indexed pension issue.

ANNEX A

THE SUPPLY OF, AND DEMAND FOR, INDEXED BONDS

A. The Demand for Indexed Bonds

In Scenario 1 eligible holders of indexed federal bonds are limited to institutions administering pension and retirement saving programs, namely trusteed pension funds, insurance companies with respect to their annuities' and segregated funds' operations, and all financial intermediaries with respect to Registered Retirement Savings Plans (RRSPs). The total asset base and current cash flow involved in these activities in 1976 was $39.5 billion and $6.2 billion respectively.

To quantify what proportion of these outstanding holdings might be converted into indexed bonds, and how much of this annual cash flow might be invested in indexed bonds, the pension fund sector was divided, somewhat arbitrarily into three separate components, each of which might react differently to the availability of indexed bonds. Firstly, there are the small pension funds (with assets of less than $1 million). Secondly, there is a group of public sector funded plans comprising federal and provincial Crown corporations, boards and commissioners, civil services of five provinces, and municipalities and municipal agencies (but excluding teachers' federations, educational institutions and health organizations). This group is already exposed to an indexing risk and generally more restricted in its investment powers than the 'average' funded plan. Finally, there is the residual of all other plans.

Small funds generally have had a poor investment performance. During the last decade during, they tended to be heavily committed to mutual funds and pooled funds typically operated by large institutions. Investment managers do not actively seek these accounts because the potential remuneration is not commensurate with the work involved. Therefore, small funds are left with the choice of continuing to invest through trust and insurance companies or to administer their own arrangements (via a trustee). With the availability of indexed bonds, one might expect that most, if not all, existing assets and new cash flows of small funds would be channelled into those instruments.

In recent years there has been a tendency among pension funds to move into quasi-indexed assets, e.g. liquid instruments and mortgages. This appears to reflect in large part the realization that the rates of return on these short- and medium-term assets are more elastic vis-à-vis inflation than the rates on other investment instruments. To the extent that liquid assets were used as quasi-indexed instruments, much of the future demand for indexed bonds among all other pension funds might well, therefore, arise from a reduction in such assets. Since, however,

public sector funds did not follow the general trend towards a historically high ratio of liquid assets, relatively less demand for indexed securities could be expected from the substitution by public sector funds of indexed securities for liquid assets.

Among all other funds, the ratio of liquid to total assets reached a peak in the 10% range by the end of 1974, a much higher ratio than that of previous years. This also suggests the existence of a significant demand for indexed bonds. In addition, the magnitude of their bond holdings is such as to warrant the expectation that some displacement by indexed bonds would take place.

The potential demand among trusteed pension funds for indexed bonds, disregarding the effect of the actual real rate at which these bonds might be offered, might therefore conceivably evolve as follows. Note that the numbers that follow, while they have some element of logic in them, are by no means projections. They are simply assumptions. They are intended only to provide an initial 'ballpark' estimate of the demand for indexed bonds.

Trusteed Pension Funds	Asset Basis $ billions	Cash Flow Basis $ millions
1. Small Funds		
60% of assets (including liquid assets, pooled funds and bonds)	0.3	
100% of cash flow		67/p.a.
2. Public Sector Funds Excluding Health and Education		
nil of liquid assets or pooled funds		
40% of bond portfolio	1.9	
50% of cash flow		660/p.a.
3. All Other Funds		
50% of liquid assets	0.6	
60% of pooled funds	0.8	
40% of bond portfolio	2.8	
50% of cash flow		940/p.a.
Total	6.4	1,857/p.a.

With regard to the annuities aspects of the insurance business, over half the assets involved were already invested in quasi-indexed instruments (mortgages and liquid assets) with almost the entire balance being held in the form of fixed income securities. This would appear to suggest that the annuities business might possibly constitute a substantial source of demand for indexed bonds from liquid asset replacement:

Insurance Cos.-Annuities	Asset Basis $ billions	Cash Flow Basis $ millions
Excludes amounts covered under trusteed plans and RRSPs		
40% of bond portfolio	0.7	
50% of liquid assets	0.2	
100% of cash flow		400/p.a.
Total	0.9	400/p.a.

In the segregated funds' operations, the insurance companies displayed quite a different strategy; while bonds, mortgages and liquid assets account for a relatively insignificant share, over half the assets of segregated funds were held in the form of equities. The resulting demand for indexed bonds might be as follows:

Insurance Cos.-Segregated Funds (excludes amounts covered under trusteed plans and RRSPs)	Asset Basis $ billions	Cash Flow Basis $ millions
25% of bond portfolio	0.1	
50% of liquid assets	0.1	
25% of cash flow		105/p.a.
Total	0.2	105/p.a.

Finally, one of the remarkable features of RRSPs is their very high proportion of liquid assets, presumably including a large number of Guaranteed Income Certificates (GICs) of the trust companies which administer many RRSPs. Since it is unlikely that the trust companies would willingly surrender funds already held in this form, and since most of these assets are in the form of fixed-term deposits, the likely proportion of these assets to be converted into indexed bonds in the first instance might not be very great:

RRSPs	Asset Basis $ billions	Cash Flow Basis $ millions
25% of bond portfolio	0.3	
35% of liquid assets	1.1	
40% of cash flow		670/p.a.
Total	1.4	670/p.a.

The foregoing data may be summed as follows:

Grand Total	Asset Basis $ billions	Cash Flow Basis $ millions
Amount	8.9	3,032

In summary, these numbers seem to suggest a demand for indexed bonds from the conversion of existing assets equal to around \$9 billion and \$3 billion from current cash flow. For reasons outlined earlier, fund managers might find it difficult to quickly convert the desired proportion of their existing asset base into indexed bonds. Assuming, therefore, that such conversions were to be phased in over a five year period, this would result in an annual conversion rate of \$1.8 billion. Thus, on the basis of the above calculations the total initial five-year demand for indexed bonds might be estimated to be in the \$4.8 billion range annually.

Note that these calculations were done in respect of 1976. Updating this tentative analysis in terms of current demand is difficult, as some of the basic data are not available. However, it is known that the assets of trusteed pension funds grew by nearly 40% and cash flow by perhaps 50%, between the end of 1976 and the end of 1978. On the other hand, with the improved stock and bond market performance, the temptation to switch to indexed bonds might not have increased at the same rate. As a very rough estimate, therefore, 1978 demand in the range of \$5 billion annually might not be too far wrong.

One further point might be noted. If, in fact, it were to take five years to convert the desired level of the existing stock of non-indexed pension fund assets into indexed assets, the demand for indexed bonds would subsequently decline (in constant dollar terms) subject to further growth of the system. The \$4.8 billion 1976 demand would fall to \$3 billion; or in 1978 terms, the \$5 billion might decline to roughly \$3.2 billion annually. Note further that a conversion within five years might well be practical in the sense that government cash requirements look like they will be very large by historical standards in the several years ahead, so that the capacity to supply abnormally large volumes of bonds (in this case indexed bonds) is perhaps within the realm of possibility.

It cannot be stressed sufficiently, however, how tentative these numbers are. They should be taken only as an extremely subjective estimate of possible demand levels for indexed bonds for retirement income funding purposes, if the supply were available to meet it.

B. The Supply of Indexed Bonds

To determine the amount of indexed bonds the federal government might be able to supply, a review has been made of federal financing requirements over the last decade. There are four main sources of borrowing: Treasury Bills (TBs), Canada Savings Bonds (CSBs), marketable bonds and government employee pension plans. Of these, it has been assumed that the latter must be left out of the calculations entirely. Furthermore, as was the case for the demand analysis, price considerations were not taken into account.

It has been assumed that a significant proportion, i.e. 30% of CSBs might be diverted into indexed bonds. This in part reflects the fact that, on a few occasions in the last decade, the government has sold very large quantities of CSBs to assist its tight cash requirement

position (in particular in 1971, 1974 and 1975). A significant portion of those cash requirements might have been met by loans from pension funds.(1) Moreover, there is no overriding need to meet CSB demand at historical levels, though presumably the government would have an interest in keeping that market alive and well, having developed it over the years. In any event, the 30% figure might be lower than is feasible, resulting in a downward bias to the results.

With respect to TBs, only a 10% conversion is assumed, as it is arguable that the requirements of monetary policy would impose a substantial constraint on the monetary authorities with regard to the volume of TBs that could be replaced.

As for marketable bonds, a 30% switch to indexed bonds is assumed. Anything beyond that figure might mean that the government would endanger the continuance of a sufficiently diversified market for its securities. And even 30% might be considered a bit on the high side, introducing an upward bias to the results.

Note that the assumptions for TBs, and more particularly for marketable bonds, might not be readily achievable. For example, during the ten years from 1967 to 1976, almost all net new bonds and bills were taken up by the banking system (or non-residents). While this situation has altered in the last couple of years, it is arguable that, for the period as a whole, central bank requirements for bonds and bills, related both to money supply expansion and the conduct of open market operations, and chartered bank requirements for bonds and bills for liquidity purposes, would have made the 30% and 10% assumptions unrealistic. It is assumed here, however, that if indexed bonds had existed, monetary policy might have been implemented in a somewhat different manner and the banking system could have adjusted its modus operandi to get along with fewer federal securities. Although traditionally the chartered banks have looked upon federal securities as their preferred instrument for liquidity purposes, it might have been possible for the central bank to help develop an active market for other instruments, such as commercial paper, if as a result of the introduction of indexed federal bonds the supply of marketable federal securities were to prove insufficient to meet the liquidity needs of the banking system.

The estimate of demand for indexed bonds set out above was couched initially in terms of 1976 conditions. Therefore, the supply side is also examined initially in terms of that year. In 1976, net new CSBs sold were equal $0.8 billion. The net treasury bills issued in 1976 were equal to $1.6 billion. This implied a potential supply of $0.4 billion (30% of $0.8 billion plus 10% of $1.6 billion). In addition, gross issues of marketable bonds were equal to $3.95 billion (excluding CSBs and TBs), of which 30% or $1.2 billion might have been indexed bonds. Thus, in that year, about $1.6 billion in indexed federal bonds might have been made available. Gross figures are used for other marketable

(1)It may be significant in this context that since 1974, when the federal government re-entered the long bond market after several years absence, pension funds have been adding to their Canada bond holdings in a substantial way.

bonds since there is no reason not to include rollovers of that type of security as a potential source of supply.(2) Net figures have been used for TBs and CSBs, since TBs may be rolled several times annually, and since CSBs, owing to their encashability feature, may also be rolled over. However, assuming most CSBs are not rolled over, using net figures introduces a downward bias to the potential supply.

In 1976, the provinces had gross new issues of \$5.4 billion in Canadian dollar bonds. Eliminating about \$1.9 billion for Canada Pension Plan (CPP) and Quebec Pension Plan (QPP),(3) \$3.5 billion was sold in Canadian dollar bonds. Assuming that 30% might have been sold to pension funds as indexed bonds, about \$1.0 billion of indexed bonds might have been supplied by the provinces in that year.

Thus, looking at the federal and provincial governments together, if our estimate is based on 1976 alone, a \$2.6 billion supply might have been feasible (\$1.6 billion federal and \$1.0 billion provincial).

One question is whether the 1976 results were in some way atypical and, therefore, whether \$2.6 billion would be an appropriate estimate to use. An alternative perspective is provided by looking at 1972-1976 in aggregate. In that period, annual net new CSB sales averaged around \$1.3 billion. New TBs issued averaged \$0.8 billion annually. Using the same proportions as earlier for converting CSBs and TBs to indexed bonds, \$0.5 billion rather than \$0.4 billion might become available from the diversion of CSBs and TBs into indexed bonds.

Gross issues of other federal bonds averaged \$2.5 billion annually over the same five years, which might have permitted \$0.8 billion annually in indexed bonds. From this alternative perspective, i.e. looking at 1972-1976 in aggregate, \$1.3 billion annually, rather than \$1.6 billion, might be the safer estimate.

For the 1972-1976 period, gross sales of provincial bonds denominated in Canadian dollars, excluding CPP and QPP, equalled \$2.3 billion annually. Of that amount, 30% equals \$0.7 billion. Thus, if a five-year perspective is used, \$2 billion annually might be more appropriate (\$1.3 billion federal and \$0.7 billion provincial) than \$2.6 billion.

The estimate of supply available in 1978 could have been much higher than this \$2 billion due to the exceptional federal cash requirements. Indeed, in that year, it could perhaps have been in the \$3-4 billion range. This goes some distance towards meeting the estimated \$5 billion demand in that year. Given the likely cash needs of governments during the next several years, the 1978 supply figure might well be more typical of what is possible during the next few years than the 1972-1976

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(2)Gross figures would be appropriate only until the first issues of indexed bonds mature after which net figures would be more appropriate.

(3)Gross saving of social security funds was \$2.2 billion. Of this, \$1.5 billion was CPP money invested in provincial securities. Of \$522 million in QPP funds, it is assumed that the Caisse de Dépot et Placement invested \$0.2 billion in Quebec bonds.

average.

Thus, it is conceivable that federal and provincial governments might jointly be able to meet a substantial proportion, say, two-thirds of the possible demand for indexed bonds over the next several years without damaging in any significant way the depth and breadth of the market for their securities. It bears repeating, however, that a supply of this size appears to require some adjustments in the demand for federal securities on the part of the central bank and the chartered banks.

It is also important to bear in mind that as governments gradually reduce their deficit position (whether it takes three, five or ten years) and hence their cash requirements, the potential supply of indexed bonds will be reduced. It is also the case that the demand for indexed bonds might in one sense begin to ease as the initial backlog of demand for such bonds would perhaps be satisfied after, say, five years. On the other hand, as noted earlier, the overall rate of growth in private retirement fund assets might increase relative to all financial assets. Thus, the possibility cannot be ruled out that after five years or so, the potential supply from governments would decline relative to the potential demand.

ANNEX B

THE IMPACT OF INDEXING ON PUBLIC DEBT CHARGES

Indexed bonds give rise to two types of risks as regards public debt charges: the risk of the increased unpredictability of the dollar value of public debt payments in the short run, and the risk that, if inflation were to accelerate, such payments might become a serious burden on the budget. These issues will be considered in turn.

The impact of the existence of indexed bonds on the short-run predictability (i.e. the predictability of expenditures in the fiscal year one year ahead) of government cash requirements for public debt servicing purposes(1) depends on the type of indexed bond which has been issued and the type of non-indexed debt instrument which it replaces. For a 'principal compensation bond', the margin of uncertainty for the following year's debt servicing payments is a function of the degree of uncertainty in the next year's inflation forecast and of the nominal value of the principal of, and the 'real' interest payment on, such bonds. For an 'indexed principal' bond, the margin of uncertainty in the next year's debt service charges depends on the uncertainty in the inflation forecast and on the real interest payment on all indexed bonds outstanding plus the value of bonds maturing that year.

The point may be illustrated for a case in which there is an amount (B) of indexed bonds outstanding with a face value of $10 billion, the 'real' interest rate (r) payable on these bonds is 2%, one-tenth of the bonds mature each year, the forecast rate of inflation (i) is 5% with a margin of uncertainty (u) one year ahead of 2%. Cash payments on $10 billion of principal compensation bonds would equal the real interest on the entire amount, plus a sum to compensate lenders for the reduced real value of their bonds, plus the repayment of the principal on the fraction maturing. They can be calculated as follows:

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(1)The analysis is cast in terms of debt charge cash flow. Questions would arise concerning the accounting treatment of the 'inflation compensation' component of such payments, and concerning the accrual of liabilities for future inflation compensation payments on the principal of 'indexed principal' type bonds. The following discussion assumes that accrual of such liabilities would not be recorded as part of current expenditures.

$$= \quad r(1 + i \pm u)B$$

$$+ \quad (i \pm u)B$$

$$+ \quad \frac{1B}{10}$$

$$= .02\ (1 + .05 \pm .02)\ \$10 \text{ bil.}$$

$$+ \quad (.05 \pm .02)\ \$10 \text{ bil.}$$

$$+ \quad \frac{1}{10} \times \$10 \text{ bil.}$$

$$= \quad \$1.71 \text{ bil.} \pm \$.204 \text{ bil.}$$

i.e. the margin of uncertainty is $204 million.

Cash payments on $10 billion of indexed principal bonds would equal the real interest on the entire (indexed) amount, plus the repayment of the indexed principal on the fraction maturing:

$$= \quad r(1 + i \pm u)B$$

$$+ \quad (1 + i \pm u) \times \frac{1}{10} \times B$$

$$= \quad .02(1 + .05 \pm .02)\ \$10 \text{ bil.}$$

$$+ \quad (1 + .05 \pm .02) \times \$1 \text{ bil.}$$

$$= \quad \$1260 \text{ bil.} \pm \$.024 \text{ bil.}$$

i.e. the margin of uncertainty is $24 million.(2)

As an indication of the comparable margin of uncertainty on non-indexed bonds, assume that there is a 2% point margin of uncertainty on the short-term (Treasury Bill) interest rate forecast, a 1% point margin of uncertainty on the long-term bond interest rate forecast, and that one-tenth of the stock of long-term marketable bonds mature each year.

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(2)In comparing this figure with the $204 million margin of uncertainty on principal compensation bonds, it should be kept in mind that in the case of indexed principal bonds the face value of the bonds outstanding either understates the amount actually owing to bond holders or alternatively <u>exceeds</u> the face value at the time of issue depending on whether face value does or does not include inflation compensation accruals with respect to previous years. <u>The two sets of results very specifically should not be taken as providing an insight into the relative borrowing costs of the two types of indexed bonds</u>.

Then the margin of uncertainty on the cash payment on $10 billion of TBs would be $200 million, while the margin of uncertainty on payments on $10 billion of long-term bonds would be only $10 million. Since it has been assumed that indexed bonds would mainly displace long-term bonds, it appears that their use might lead to a greater margin of uncertainty in short-term debt payment forecasts, although this margin would still be relatively small in the case of indexed principal bonds. However, to the extent that indexed bonds displaced CSBs, the analysis would fall between the TB and long-term cases.

The larger margin of uncertainty on the dollar value of public debt charges associated with indexed bonds would apply to medium-term as well as short-term forecasts. However, once the time horizon extends beyond the maturity date of bonds outstanding at the time of the forecast, it is not readily apparent whether indexed or non-indexed bonds give rise to the larger margin of uncertainty. The issue would turn on the relative predictability of nominal interest rates, inflation rates and real interest rates. Perhaps more important than predictability of the dollar value of debt charges, particularly in the medium-term, are the implications of indexation for debt charges relative to total expenditures, revenues or (GNP). With indexed principal bonds an acceleration of inflation would not be expected to lead to an increase in the short run in the ratio of debt charges to revenues from the existing tax structure or to GNP.(3) On the other hand, use of the principal compensation bond could give rise to greater short-run instability in the ratio of debt payments to revenues or GNP than at present because of the need to compensate bond holders in full for the loss in real value of their bond in the very year that loss occurs. Especially under a government policy of maintaining a relatively stable ratio of total expenditures to GNP, it would seem advantageous to minimize fluctuations in the ratio of public debt charges to GNP. Use of indexed principal bonds would thus be preferable to principal compensation bonds from this point of view.(4)

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(3)An exception to this generalization, which could be of some significance over periods of one or two years, would occur if the increase in the inflation index used to adjust bond payments resulted from price changes that occurred outside the economy and which were thus not associated with higher current dollar GNP and higher government revenues. Such would be the case, if the Consumer Price Index (CPI) were used as the index, and if some event or action caused a major increase in import prices. Indices which would be less likely to give rise to such a problem could be developed, but are not currently familiar to the public.

(4)Given the tendency of nominal interest rates to increase with inflation, the same tendency for debt charges to increase relative to GNP, as inflation accelerates, exists for unindexed bonds <u>if one considers a period long enough for the bonds to mature</u>. However, as maturity of the existing stock is spread out, the increase relative to GNP is much more gradual for unindexed bonds than it would be for principal compensation indexed bonds.

APPENDIX 13

STABILIZATION FACILITY: SOME TECHNICAL ISSUES

Harvey Lazar and Nicholas Rost van Tonningen*

A. Introduction

This appendix elaborates on the discussion of a government operated stabilization facility referred to in the Task Force report. The report notes that if employers are required to price index their pensions, that portion of their pension liabilities is governed by a factor - the price index - over which the employer has no control. If prices rise rapidly, pension liabilities rise at that same rate; and since real rates of investment return on fixed-income assets tend to decline when rates of inflation are rising (and vice versa), this creates deficiencies in the pension fund - deficiencies which must be amortized. Hence, employer pension costs rise.

The deficiencies referred to here are frequently turned into surpluses when rates of inflation start to decline. The purpose of the stabilization facility is to reduce the short- and medium-term volatility in employer pension costs that is mainly attributable to the effect of changing rates of inflation on investment returns. In doing this, the stabilization facility would be part of a group of measures, all of which now help reduce volatility in pension costs. At present, volatility is reduced by actuarial conventions which allow actuaries some discretion in valuing pension assets and pension liabilities. It is reduced further by allowing pension plans to amortize deficits over periods of some years.

The stabilization facility would further reduce volatility of costs by guaranteeing that real rates of investment return earned on financial assets of pension funds in any one year will reflect the average real rates that have been available over a period of years.(1) If current real returns on financial assets are adjusted so that they reflect real rates that have been available in the past, the adjusted real rates of return earned by pensions become more predictable and more stable than otherwise. As already noted, if pensions are indexed and no such facility or similar mechanism exists, rising inflation will have the effect of increasing pension fund liabilities while simultaneously reducing the market value of most fixed-income assets in the pension fund.

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(1) The assumption is that during the longer time period there will be years of rising rates of inflation and years of falling rates of inflation and thus years of rising and falling current interest rates. Current interest rates, of course, affect overall rates of return (including changes in capital value) on fixed-income securities.

A stabilization facility would operate as follows. Some accepted method would be adopted of defining the average real rate of return earned on financial assets during any one time period, say a year. This would be called the 'benchmark' rate of return. There would also be some generally known and accepted method of determining the average real rate of return on financial assets over a longer time period - the 'standard' rate. At the end of each year, the benchmark rate for that year would be calculated and compared to the standard rate. If the benchmark rate were lower than the standard rate, payments would be made by the facility to participating pension plans and other institutions (e.g. life insurance companies). (For the remainder of this text, reference will be made to pension funds only, but some other institutions might well be covered by such arrangements.) The size of each payment would be a function of the amount of the difference between the benchmark rate and the standard rate and of the volume of covered assets of the pension fund. If the benchmark rate were higher than the standard rate, the flow of payments would be in the opposite direction. Thus, if pension fund assets of $1 billion were covered, for every percentage point of difference between the benchmark rate and the standard rate, compensation of $10 million would be paid or received. Unlike an indexed bond, or the real rate annuities, this proposal does not guarantee investment returns. All covered assets would be affected regardless of the actual rate earned, so that if one pension fund earned 7% on its portfolio, and another 5%, each would have its returns adjusted by one percentage point. Consequently, the incentive to maximize returns would remain.

In the following paragraphs some considerations relevant to the selection of a benchmark and a standard rate are outlined, as well as some financial aspects of the operation of a stabilization facility.

B. Benchmark Rate

To arrive at the selection of a benchmark, the rate of return on financial assets has been assumed to comprise three major components: (1) the basic rent for the use of capital (the real rate); (2) the compensation for the loss of purchasing power (i.e. the inflation compensation); and (3) a risk/liquidity factor (a function of the quality of the borrower and the liquidity of the instrument). Ex post facto, the annual changes in the Consumer Price Index (CPI) can be used as a proxy for the inflation compensation component. Therefore, the key to the selection of an appropriate benchmark would be to identify an instrument sufficiently low in risk and sufficiently liquid as to permit the assumption to be made that its risk/liquidity factor would be zero or close to zero. In that case, the rate of return on the asset concerned, adjusted for inflation, would constitute a reasonable proxy for the real rate of return on financial assets for the year in question.

In Canada, the federal government has traditionally been in the lowest possible risk category among borrowers. In addition, in part at least because of the marketing activities undertaken by the central bank of federal securities in implementing monetary policy, the market for these federal securities has a depth and breadth second to none. Thus, Government of Canada securities appear to satisfy the risk and liquidity criteria, which would make them suitable for benchmark purposes.

With the use of federal securities as the basis for the benchmark in a stabilization facility, a question remains as to what class or type of Government of Canada security, or combination of Government of Canada securities, should be selected.(2) Since pension liabilities are typically long-term in nature, all other things being equal, pension funds tend to invest a substantial proportion of their assets in securities with a long term to maturity, or in equities which, in a sense, are perpetuals. A benchmark rate based on the rate of return on Government of Canada bonds with a long term to maturity would, thus, appear appropriate.

C. Standard Rate

The other fundamental decision to be made regarding a stabilization facility relates to the standard rate. Broadly, there are two alternatives. Firstly, the standard rate could be a fixed rate (e.g. 2%), on the basis of an examination of historical data and a best judgment about the future. Alternatively, the standard rate could incorporate a formula for change. If a fixed standard rate were selected, and it proved to be incorrect, the stabilization scheme would exhibit a fundamental tendency towards disequilibrium. For instance, if the standard rate chosen were 2%, and real rates averaged 1 1/2% over the next 20 years, over time pension funds would be over-compensated and the facility burdened with ever mounting deficits. If the rate were set too low, compensation would be inadequate and the scheme subject to criticism as chronic surpluses built up in the facility. These difficulties could be overcome, or at least mitigated, if provisions were to be made for the periodic adjustment of the standard rate in the light of experience but, in that

(2)Whatever benchmark is selected, there will be disadvantages. In the case of a benchmark based on long Canada bonds, caution is warranted on at least two counts. Firstly, in its debt management policy, somewhat greater attention might have to be given by the federal government to ensuring an adequate distribution of new debt issues to avoid situations under which rates of return on long Canadas fluctuate in a manner having less to do with fluctuations in the real rate of return than with the scarcity of issues in the market. Secondly, if conservatively managed pension funds sought unusually large amounts of benchmark-type securities so as to further limit the volatility of the rates of return on their portfolio, it might be necessary to impose limits on the holding of benchmark-type securities by pension funds. Such an initiative would be directed at helping to ensure the continued existence of a market with sufficient numbers of buyers and sellers to make the price mechanism work effectively.

case, it would be misleading to describe the approach as one involving a fixed rate.(3) Note again that a fixed standard rate does not guarantee real returns at the fixed rate. Suppose the fixed rate were 2%. All pension fund assets would be adjusted by the difference between the current benchmark rate and 2%. Thus, if the benchmark rate were 1.5% this year, and industrial bonds returned 3% after adjustment for inflation, the holders of industrial bonds would benefit from the 0.5 percentage point upward adjustment just as those holding long Canadas that returned 1.5% would benefit by a 0.5 percentage point adjustment.

An alternative would be a flexible standard rate. For instance, the standard rate might be the moving average of annual benchmark rates for some fixed historical period. This 'flexible' approach does not provide pension planners with the same certainty about real rates of return as the fixed rate approach. But because the standard rate would to a substantial extent reflect already known historical data, pension planners would have more certainty than is now the case. For instance, suppose the standard rate were a 15-year moving average of real rates on long-term Canada bonds. In that case, at the time of a triennial actuarial valuation, pension planners would have the advantage of knowing 12 of the 15 annual real rates which eventually would be used to determine the standard rate during the third and final year of their immediate

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(3)Note that a stabilization facility with a fixed standard rate is similar in concept to the real rate annuity scheme described in the Task Force report and in works by James Pesando, although the mechanism is different. In the real rate annuity approach, annuities are acquired at a fixed real interest rate on the assumption that indexing payments will be paid for by inflationary earnings. If the price index rises by more or less than is implicitly anticipated at the time the annuity is acquired, the seller of the annuity makes a payment to or receives a payment from the government. For instance, if the real rate guarantee is 2%, and the annuity rate includes 9% interest, the issuer has enough inflationary earnings to adjust pensions by 7% annually. When the CPI deviates from 7%, adjustment payments flow in one direction or another. In the fixed rate stabilization facility, payments are triggered when the real rate of return on the benchmark assets deviates from the fixed rate - say 2%. Thus, under the real rate annuities approach, adjustment payments are made when <u>expenditures</u> in the form of annuities are more or less than expected whereas, with the stabilization facility, adjustment payments are made when the real rates of return, i.e. the real <u>incomes</u> (including realized and unrealized capital gains and losses) available on the assets which constitute the benchmark are more or less than the standard rate.

forecasting period. For the first year, they would know 14 of the 15 annual rates that would make up the average. This would provide stability and predictability in their short and medium real rates.(4)

One question that would have to be considered if a standard rate based on a moving average were adopted is the length of the time period to be covered. There is a trade-off here. The shorter the time period for calculating the moving average, the quicker the standard rate will adjust to changing circumstances and the less likely a chronic disequilibrium in the facility will emerge. Consequently, the smaller the exposure to the risk of greater than expected costs on the part of the government. But with a short time frame, say five years, the degree of certainty provided to pension funds about their rates of return would be very limited - too limited to be of much value to pension funds. On the other hand, if an extremely long period were chosen, changes in the standard rate would be very gradual and pension funds would enjoy a great deal of certainty. But a disequilibrium in the facility might well be extremely slow to reverse itself and the government would, thus, be exposed to greater risks in terms of financial exposure. A 15- or 20-year moving average might constitute a reasonable compromise between the two sets of conflicting interests.

D. Financial Aspects

With a flexible standard rate, the real rates being 'guaranteed' would rise and fall over time with actual market experience. If the initial standard rate happened to be 2%, and this were followed by several years of real rates of less than 2%, as might be expected in a period of rising inflation, this would result in a flow of payments from the facility to the pension funds. At the same time, however, the standard rate would itself be declining. If rates of inflation were then to decline, real rates of investment return on fixed-income securities would tend to rise again and would soon exceed the standard rate, which would itself have declined by that time. Thus, the flows would be reversed. In other words, there should be a tendency for the deficits and surpluses to balance out over the long term even though, at any point in time, the facility would likely be in surplus or default.

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(4)Another possibility would be to use a standard rate based on a trend-line line. Compared to a moving average, a trend-line rate has the advantage of being less distorted by the occurrence of extraordinarily high or extraordinarily low rates of return in any single year. The effect of such extreme values can be particularly significant if they occur at the beginning or end of the moving average time period. While the trend-line rate would still be affected somewhat by the occurrence of a substantial non-conforming rate, the impact of such a rate would nevertheless tend to be less automatic and more muted than it would have been if a moving average had been used. To the extent, however, that a trend-line rate would result in a slower adjustment to changing circumstances, the risk for the facility might increase.

But there is no firm guarantee that a long-run deficit or surplus will not occur. This is most likely if there is a secular change in the real return to financial assets. For instance, if real returns averaged 1 1/2% per annum in the last 15 or 20 years, and they average only 1% over the next 20 years, then a chronic deficit would develop during the latter period.

The size of the deficit, in such a situation, would depend on the amount of assets covered. If the only assets covered were those held in respect of pensions and annuities-in-pay, the covered assets might be in the $15 billion range. If all the assets of trusteed and insured pension funds were covered, the figure would perhaps be closer to the $45 billion range. In the latter case, annual flows to or from the facility of several hundred million dollars would well be possible though - as already noted - there would be a tendency for the flows to balance out over time.

In the event of a secular decline in the standard rate, say, a 20-year period which began with a 1 1/2% standard rate, but in which the benchmark rate each year was only 1%, a deficit of about $3 billion would be incurred assuming $45 billion in assets were covered throughout that time span. After 20 years of the 1% real returns, however, the deficit in the facility would grow only by the rate of interest charged on the deficit, because the benchmark rate and standard rate would by then be equal. In fact, there is no reason to expect a secular change in the real returns on financial assets. Of course, if there were such a change, and no government stabilization facility or its equivalent existed, employers, employees and/or pensioners would have to pay the price for the change.

A prolonged disequilibrium situation is more likely to occur under a fixed rate system than it is under a flexible rate system.

E. Payments

Payments by the facility to participating pension funds could conceivably be made in cash. This could have substantial financial and economic ramifications for the federal government regardless of whether the cash came from existing cash balances on hand or from the proceeds of new bond issues. In addition, if the facility were to be allowed to hold cash, the operation of the facility would become more complicated, because it would become necessary to establish machinery to manage cash resources. The investment/disinvestment activities of the facility could also have a distorting effect on financial markets. However, the stabilization facility need not generally require cash flows.

The facility could operate equally effectively through the issue of special instruments of indebtedness to participating pension funds. Such instruments would be usable only in transactions between

the facility and the pension funds participating in the scheme.(5) Pension fund assets normally must produce an income stream if pension fund cost projections are to be realized. This means that any instrument of indebtedness issued by the facility should carry a rate of interest. The question is how that rate of interest is to be determined. Given the fact that the whole objective of a stabilization facility is to reduce volatility in pension costs due to inflation-related fluctuations in pension fund earnings, two possible bases for determining remuneration might be considered. Firstly, the rate to be paid annually could be the standard rate plus inflation compensation. Alternatively, the interest could be based on the yield on some money market security, since these yields are generally sensitive to changes in inflation rates. In any case, the remuneration rate should be determined each year for the previous year; any longer time frame would likely contribute unduly to the volatility of returns.

Payments by pension funds to the stabilization facility under the scheme pose an entirely different set of problems. Many pension funds have restrictions on their ability to borrow money; they would, therefore, find it difficult, if not impossible, to discharge their obligations to the facility through the issue of instruments of indebtedness. Accordingly, introduction of a stabilization facility might require some changes in these restrictions.

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(5)Some provision would need to be made, however, for cashing in such securities under certain circumstances, e.g. termination of a fund. In that case, the fund concerned could perhaps be allowed to turn these instruments in for cash from the facility at the same time as it was liquidating its other assets in the market place.

APPENDIX 14

EFFECT OF GROWTH OF EMPLOYER-SPONSORED PENSION SYSTEM ON OWNERSHIP OF CANADIAN EQUITIES

E. Bower Carty*

This appendix sets out briefly several aspects of the growth of the employer-sponsored pension system which, while not central to this study, appear to be important enough to merit consideration in their own right. This observation would be further strengthened if some of the policy options described in the report were to be adopted.

In brief, with the growth in employer-sponsored pension arrangements, an increasing proportion of the value of the shares traded on the Canadian stock exchanges are being acquired by pension funds. Holdings of Canadian equities by pension funds equalled about 15% of the quoted market value of Canadian shares listed on the Toronto Stock Exchange (TSE) at the end of 1976. Data supplied by the TSE indicate that if the value of so-called 'control blocks' had been excluded from the total, the figure might have exceeded 25%. From Statistics Canada data, it is clear that these percentages had been rising for some time. Furthermore, other large institutions, mutual funds and insurance companies in particular, also hold substantial amounts of the values of outstanding shares. Thus, the questions relating to the institutionalization of stock ownership extend beyond the pension area.(1)

Three particular implications appear worthy of consideration:

- to the extent that voting rights are not exercised on shares held by pension funds, the plan members, who are arguably the beneficial owners of the shares, are, in a sense, disenfranchised;

- to the extent that large blocks of shares are not voted, the recognized ability of directors and managers to perpetuate their control of corporations whose ownership is widely held may thus be strengthened; and

- the operations of the securities markets are affected by the concentration of substantial power in the hands of relatively few large institutions.

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* Task Force on Retirement Income Policy. Department of Finance.

(1) It is understood that the Securities Market Study Group based in the Department of Consumer and Corporate Affairs has not dealt with these issues.

APPENDIX 15

SOME COMMENTS ON SURVIVORSHIP BENEFITS IN PENSION PLANS

Hart D. Clark*

This appendix contains a brief outline of the extent and nature of the survivorship provisions of employer-sponsored pension plans based on data compiled by Statistics Canada.(1)

Unlike the situation in a number of other countries, there are no legislative requirements in Canada governing the survivorship in employer-sponsored plans. As might be expected, therefore, there is considerable variation in the type of benefit made available to a surviving spouse of a member among those plans which contain some type of survivorship provisions.

Approximately 45% of all pension plan participants in 1976 were in plans which automatically provided a continuing pension of varying size to the widow of a plan member.(2) The most usual provision was for a pension equal to 50% of the employee's pension in the case of death after retirement and the same proportion of accrued pension benefits in the case of death before retirement. (For example take an employee who, when he dies at age 50, has enough pensionable service credits to provide him with an annuity of $5,000 annually at normal pensionable age. Under such a plan his widow would receive an immediate pension of $2,500.) Automatic survivorship provisions of this nature were confined in the main to the plans of large employers.

The second most common provision, covering 29% of all participants, was for the continuation of payment for a guaranteed period of a pension to the beneficiary of a deceased former employee equivalent to 100% of that received by the latter. While the normal guarantee period provided by such a plan ranged up to 20 years after the employee retired, 5 and 10 year periods were more common. Such plans generally also provide the options of guarantee periods other than the normal one under the plan. The benefit level is then determined on an actuarial equivalent basis in relation to the normal guarantee. It should be noted that the beneficiary need not be the spouse of the plan member and that payments are not continued beyond the guarantee period even if the beneficiary is still alive.

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* Task Force on Retirement Income Policy. Department of Finance.
(1)Statistics Canada, Pension Plans in Canada 1976.
(2)As human rights legislation is extended in the various jurisdictions, an increasing number of plans are providing widowers' pensions as well.

The third most common provision is one which pays the beneficiary the total of the employee's contributions minus the pension benefits which he received before death.

Table 1 shows the types of survivorship benefits provided to pension plan members in the public and private sectors in 1976. Plans covering 71% of the members in the public sector provide automatic protection for survivors compared with only 24% in the private sector. At the same time 9% of public sector members had no survivor benefit coverage whatsoever compared with 20% of members in the private sector.

Table 1

Survivor Benefit Coverage of Pension Plan Members on Death after Retirement, 1976

Type of Survivor Benefit	Public Sector	Private Sector	All Plans
	(% of plans members)		
Automatic	71	24	45
Guarantee period	8	46	29
Balance of employee contributions	7	5	6
Other	5	6	6
No benefit	9	20	15

Most plans which do not provide a widow's pension automatically, but instead provide automatic continuation of full benefits to a beneficiary for a guaranteed period, also offer the option of a joint and survivor pension. Under this latter arrangement, a reduced pension is payable until the death of both spouses. This normally involves a substantial reduction in the level of the employee's basic pension, since it introduces the possibility that the pension will be payable over a longer period as the employee may be the first to die. If the employee chooses to have the same level of pension until the last survivor dies the amount paid might be 65% of the employee's normal pension. If the pension were to be reduced after the first death, then the pension would be higher than the 65% while both were alive and less than 65% after the first death.

In a few plans with automatic survivor pensions there are also guaranteed minimum amounts that will be paid if the employee and his eligible survivors die before the total of the benefits paid equals that minimum. The minimum amount varies from plan to plan; it might be equal to the member's contributions plus interest, or five years of pension benefits, for example. The balance is then paid to the estate.

While the approach abroad varies considerably, the trend in a number of countries has been to require employer-sponsored pension plans to provide some form of survivor's benefits. Under the mandatory private pension systems proposed for Switzerland and the Netherlands, the widow's pension is to be 60 and 70% respectively of that paid to the plan member. The normal widow's pension in Sweden is 50% in the case of private plans

that complement the public system; in France and Germany it is 60%, and in Britain it is 50%. There are more variations in the provisions for children. In the United States, the Employees' Retirement Income Security Act (ERISA) requires that unless a married employee elects otherwise in writing, all employer-sponsored plans must provide a pension on a joint and survivor basis under which at least half of the reduced pension payable to the beneficiary will continue to the spouse.

In the case of the public earnings-related pension plans, widows' benefits are normally provided in Canada and most other industrial countries. Under the Canada/Quebec Pension Plans (C/QPP) the pension of the surviving spouse who is 65 or over is 60% of the contributor's pension. The conditions governing the payment of a pension to a surviving spouse who is under 65 vary considerably, depending on a number of circumstances. As a result, he or she may be ineligible to receive any benefit or, at the other end of the scale, may qualify for a benefit that is greater by a few dollars than that paid to the surviving spouse who is 65 or over. The C/QPP also contain provisions for children's benefits.

In the United States, the widow or dependent widower under the public Old Age, Survivor and Disability Insurance system can receive 100% of the deceased insured worker's pension at age 65. It is reduced if it commences from the age of 60 to 64. Seventy-five percent of the worker's pension is payable at any age to the widow or widower caring for children who qualify.

Under the public system in Britain, the widow who qualifies for a full pension can receive 100% of her deceased husband's flat rate pension (at age 50, or at earlier ages subject to certain conditions related to children, etc.) plus 50% of his earnings-related pension. In France, the normal widow's or dependent widower's pension payable after attaining age 55 is 50% of the accrued pension of the deceased spouse. In Sweden, the corresponding figure is 40% for the widow only or 35% for her if there are children. Surviving children's benefits are payable as well subject to varying conditions, under the British, French and Swedish plans.

APPENDIX 16

EFFECT OF PROJECTED POPULATION CHANGE ON EXPENDITURES OF GOVERNMENT

Linda McDonald and E. Bower Carty*

Over the next fifty years, changes in the age composition of the Canadian population will be significant. The post-war baby boom in the period 1946 to 1962 was followed by a period in which fertility rates declined markedly. Whether or not this downward trend in fertility rates continues, stabilizes or reverses itself, over the next half century there will be a substantial increase in the proportion of the population over the age of 65, and an increase in the ratio of the elderly to the population of working age will result.

An important economic question that arises is what effect this increase in the aged-dependency ratio will have on the costs borne by the working-age population through income, payroll and other forms of taxation. This involves not only costs of programs directed specifically to the benefit of the elderly - like Old Age Security (OAS), Guaranteed Income Supplement (GIS) and Canada/Quebec Pension Plan (C/QPP) - but also those programs of general application which are of particular benefit to the elderly, such as health care.

While the costs of providing such services to the elderly will undoubtedly increase as a result of the rising aged-dependency ratio, it has also been argued that this increase in costs may be at least partially offset by a decline in the proportion of young Canadians in relation to the working-age population and a resulting reduction in the costs of programs directed particularly toward youth - such as education and Family Allowances (FA).(1)

The objective of this appendix is to analyse the impact of projected changes in the age structure of the Canadian population over the period from 1976 to 2031 on the expenditures of all three levels of government.

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* The major part of the work underlying this appendix was by Linda McDonald formerly of the Planning Branch, Treasury Board Secretariat. Additional material was developed for the Task Force by Bower Carty.

(1) Geoffrey N. Calvert has suggested in his study, Pensions and Survival, (Maclean-Hunter Ltd., 1977, pages 23-24) that the degree to which the increasing "old age burden" will be offset by a corresponding decreasing burden associated with the young will be minimal, while the Canadian Council on Social Development has contended it is likely to be significant. (How Much Choice? Retirement Policies in Canada, 1975, page 9).

Using the demographic assumptions adopted by the Task Force and described in Appendix 9, Table 1 provides an estimate of how these projected changes in demography will affect government expenditures. The figures in the table were developed on the basis of a large number of assumptions. Accordingly, the results should be interpreted as indicative only of directions of change and of very rough orders of magnitude.(2)

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(2)The table indicates how the cost of government programs in operation in 1976 would be affected by changes in the age structure of the population expected by 2001 and 2031, assuming maintenance of the existing per capita levels of services and expenditures in real terms. Age-specific expenditures cover not only expenditures on age-specific programs (e.g. OAS) but also expenditures on other programs (e.g. hospital care) which are used more heavily by some age groups than by others. The levels of expenditure at various future dates were then expressed as percentages of Gross National Product (GNP).

Table 1

Effect of Projected Population
Changes on Expenditures of Governments

Group	Government	1976	2001	2031
			(% of GNP)	
Age-specific expenditures on those aged 65+	federal	3.2	3.3	5.7
	provincial	1.3	1.5	2.7
	local	0.2	0.2	0.4
	C/QPP	0.4	2.1	4.3
Total		5.0	7.0	13.1
Age specific expenditures on those aged 0-17	federal	1.4	1.0	0.9
	provincial	4.2	2.8	2.7
	local	1.5	1.0	0.9
	C/QPP	0.1	0.1	0.2
Total		7.2	4.9	4.7
All other expenditures	federal	15.8	14.8	15.0
	provincial	9.2	8.3	8.5
	local	2.9	2.7	2.8
	C/QPP	0.2	0.5	0.7
Total		28.1	26.3	27.0
Totals	federal	20.4	19.0	21.7
	provincial	14.7	12.6	13.9
	local	4.5	3.9	4.1
	C/QPP	0.6	2.7	5.2
Total		40.2	38.2	44.8

Note: Numbers may not add due to rounding.

The data in Table 1 portray the 'pure' demographic effects on government expenditure patterns. It might be noted that the outcome in terms of expenditures as a proportion of GNP applies regardless of economic growth if levels of service per capita increase at the same rate as economic growth per capita.(3) Under this scenario, then, total government expenditures as a percentage of Gross National Product rise from 40.2% in 1976 to 44.8% in 2031. However, it should be noted that there is a decrease during the period from 1976 to 2001. All of the projected increase occurs in the following 30 years.

(3)The outcome also applies if economy-wide productivity gains add correspondingly to the cost of government programs even if there is no increase in the levels of government service per capita. The costs of programs held at constant levels of per capita service would rise to the extent that the real wages and salaries paid to those providing them grow faster than their productivity. Some programs, such as the C/QPP, are linked to the economic aggregates and their costs rise automatically with general productivity. The scope for productivity gains to moderate the effect of projected population changes on expenditures of governments is accordingly limited.

This analysis does not constitute a prediction about the level of actual program expenditures in the future. Under the methodology adopted, the 1976 structure of government programs is generally assumed to remain in place. In reality, of course, the actual level of spending on any particular program, and on the programs as a whole, will depend on political decisions that are made with respect to them.

While the projected total-dependency ratio in 2031 is roughly what it was in 1976, the young are expected to make up a much smaller proportion of the total population than they do today. Expenditures on the young under government programs were substantially lower in 1976 on a per capita basis than expenditures on the elderly. If this approximate relationship continues to apply in the future, government expenditures on dependent age groups as a proportion of GNP will tend to increase as the proportion of the elderly in the population increases, despite the relative stability of the total-dependency ratio.

The figures in the table indicate that between 1976 and 2031, federal expenditures on the elderly (other than CPP) as a proportion of GNP will increase from 3.2 to 5.7%. At the same time the analogous expenditures by other levels of government will double, rising from 1.5 to 3.1% of GNP. As the table also indicates, however, these increases will be offset to some extent by a relative decline in expenditures related directly to those under 18 years of age. Federal expenditures on programs other than the CPP for all ages of dependency will rise from 4.6 to 6.6% of GNP between 1976 and 2031, while similar expenditures by provinces and municipalities will decline from 7.2 to 6.7%.

The share of Gross National Product absorbed by C/QPP will increase in the future for two reasons. The first is that the process of phasing in the C/QPP will continue to affect the figures until after the turn of the century. Secondly, the share of C/QPP expenditures will grow as a result of the increase in the aged-dependency ratio; the impact of this development will account for most of the increase in C/QPP expenditures after 2001.

The total burden on those of labour force age of supporting the young and the old is not fully reflected by the data contained in Table 1 because it excludes age-related expenditures which are not borne by governments. A higher proportion of the costs of supporting the young is paid for privately than that in the case of the elderly. To some extent, therefore, the future increase in the relative cost of providing support to the elderly through public programs may be offset by a decline in private family costs of supporting children. Nevertheless, the central message remains unchanged: a greater share of economic output will flow to those who are elderly by the year 2031 than is the case today.

What then can be concluded about the effect on government of the institutionalization of retirement income arrangements? Firstly, other things being equal, government expenditures as a proportion of Gross National Product will rise moderately. In turn, this will require increases in rates of taxation or in pension contribution rates. It is worth emphasizing that the burden on those who finance governments - that is, the taxpayers - would not necessarily be smaller if retirement income arrangements were not institutionalized, but the vehicles through which they would cope with these responsibilities for the elderly would be somewhat different.

Secondly, it can be concluded that the institutionalization of retirement income arrangements puts an important responsibility on governments to plan and to manage effectively the process of redirecting resources from the young to the old. Also, since provincial governments have a relatively larger responsibility for the young than does the federal government, whereas the federal government has a relatively larger responsibility for the elderly than the provinces, it appears likely that, over time - other things being equal - there will be a need to have a slightly higher proportion of tax revenues flowing to the federal government and a slightly smaller proportion to the provinces.

I. DERIVATION OF DATA - INTRODUCTION

The summary data in Table 1 drew heavily on the detailed calculations and analysis contained in a study entitled "Changing Population and the Impact on Government Age-Specific Expenditures" prepared in April 1977 by Linda J. McDonald, then of the Planning Branch, Treasury Board Secretariat. The balance of this appendix summarizes parts of that study.(4)

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(4)Table 1 reflects a number of adjustments to the data in that study, including the following:

- C/QPP expenditures were broken out of the federal series and displayed separately by age group.
- Provincial 'top-ups' (like Guaranteed Annual Income Supplement (GAINS) in Ontario) for those aged 65 and over were added to age-specific expenditures of provincial governments.
- Deductions were made from age-specific expenditures of both the federal and provincial governments to allow for erosion of income-tested retirement programs due to the growth of the C/QPP.
- Non-age-specific program expenditures were derived for each level of government as the residual between its total current and capital expenditures (excluding capital consumption allowances) and its age-specific programs. (It will be noted that public service pension costs remain in the non-age-specific category.)
- Non-age-specific program expenditures were projected on the basis of population aged 18 through 64.
- Total government expenditures were related to projections of Gross National Product (which, unlike the Net National Income (NNI) projections used in the study, include an assumption of rising labour force participation rates).

The analysis focuses on two alternative demographic scenarios. The first, which is termed the 'population growth' case, examines the effects of a simultaneous growth in the size of the total population and a change in the proportion of the different age groups. This is based on the assumptions made in Appendix 9 and anticipates an increase in the population from around 23 million in 1976 to approximately 34 million in 2031. The second scenario, termed the 'population non-growth' case, assumes that the total size of the population remains at its 1976 level in an effort to isolate the effect of changes in the age structure alone on the costs of specific programs and the associated tax burden. The cost or tax burden of program expenditures has also been calculated as a proportion of NNI under varying assumptions with regard to economic growth.

Section II sets out the basic methodology that was employed to allocate program costs among age groups in order to develop total program costs and per capita costs based on the particular population projection that was adopted for purposes of the report. Section III discusses relevant programs of the federal, provincial and municipal governments Section IV outlines the results of the analysis and Section V the conclusions. Section VI contains a number of tables detailing the results of the analysis for the three levels of government under varying assumptions with respect to economic growth and two different postulations on the size of the population. Section VII provides a technical note on some of the detailed statistical data that provided the foundation for the study.

II. METHODOLOGY

The purpose of this study is to examine the effects of changes in the age distribution of the Canadian population (for the years 1976-2031) on government age-specific expenditures, given the 1976 level of service. This section describes the methodology which has been developed and utilized throughout the study. Variations to this methodology are explained in the discussion of programs contained in Section III.

A. Allocation of Age-Specific Program Expenditures by Age Group

The original study, on which this appendix is based, took as its primary focus the analysis of a variety of government programs considered to be related to populations of particular ages. Those expenditures were divided between three major age groupings: 0 to 14 years, 15 to 64 years, and 65+. The study also included a breakdown of expenditures based on an age grouping of 0 to 17 years (hereafter identified as Group 1), 18 to 64 years (Group 2), and 65+ (Group 3). It is this latter set of groups which has been adopted for purposes of the analysis that follows.(5)

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(5)For the benefit of those with a technical interest, some of the basic data grouped on the 0 to 14, 15 to 64, 65+ basis that provided a foundation for the study have been included in Section VII.

While programs such as Old Age Security and Family Allowances are age-specific by definition, others are directed more toward one segment of the population than to another by the nature of the services provided. These programs provide benefits for the total population, but many will be more heavily utilized by the old than by the young - or vice versa. Based on expenditure distributions, sub-programs of the program in question are formed for use in the expenditure calculations. Examples of programs treated in this manner are hospitalization, medical and welfare expenditures.

B. Calculation of Per Capita Program Costs

Current per capita costs have been calculated for each program or sub-program by dividing the expenditure made in 1976 by the estimated numbers of the population in 1976 in each age group utilizing the services provided. For each age group, the total per capita cost has been calculated as the sum of the per capita costs for those programs directed toward that group. The population projection that has been applied for purposes of the analysis is one of 25 made by Statistics Canada in 1974 on the basis of varying assumptions. Details of the projection adopted for purposes of this report are contained in Appendix 9. The basic assumptions underlying it are that the fertility rate over the 1976-2031 period will average 1.8 births per woman of child bearing age and net annual immigration will average 100,000.

C. Expenditure Calculations

Expenditures for future years generally have been calculated for each age group on the assumption that the level of service available to individuals will remain constant in real terms, although some exceptions to this rule will be noted later. Total expenditures for each age group, therefore, vary only as a result of projected changes in the number of people within each such group.

As noted previously, two different approaches have been adopted for the expenditure calculations in any given year. The first, the population growth case, allows for both population growth and changing age distribution as projected over time, whereas the second, the population non-growth case, allows only for changing age distribution applied to a fixed 1976 population.

D. The Burden Calculation

The burdens of the age-specific expenditures imposed on those of labour force age are defined, for the purposes of this study, as follows:

- the 'total burden' is the cost of providing age-specific program services and transfers to the dependent portion of the population (young and old) as a percentage of Net National Income;(6) and

(6)CPP expenditures for the entire population have been included in the total burden calculation, since they are made on behalf of dependants of all ages.

- the 'old age burden' is the cost, as a percentage of national income, of providing age-specific program services to the elderly.

A major aspect of the analysis is concerned with examining differences in the relative burden to be borne by the working-age sector under postulations of growth and non-growth of the total population, and assumptions with respect to the economy of zero real per capita growth, 1% average annual per capita growth, and 2% average annual per capita growth. (The zero real growth case assumes no increase in productivity, but provides for an increase in output in line with any increase in the size of the working-age population.) For purposes of simplification, it has been assumed in both positive economic growth cases that none of the age-specific government programs are similarly enriched. The costs of such programs as a proportion of Net National Income and the burden on the working-age population would, consequently, be less in relative terms than if there were no real economic growth.

III. GOVERNMENT PROGRAMS

A detailed breakdown of expenditures by federal, provincial and municipal governments in 1976 on age-specific programs, which provides the basis for the projections that follow in this appendix, is contained in Section VII. This section comments on some of the pertinent factors relating to these programs which must be taken into account.

A. Hospitalization, Medical and Education Expenditures

1. Federal - Established Programs Financing (EPF).(7) The Government of Canada introduced legislation effective January 1977, providing a new tax and cash transfer system to replace the previous cost-sharing arrangements for federal contributions to hospital insurance, medical care and post-secondary education. Under the new arrangements, federal contributions to the provinces for these programs are based on a per capita cost calculated for the base year 1975-1976; the contributions are escalated in relation to the growth of the economy (in terms of a three-year moving average of nominal national income).

Because the effects of the EPF changes on future federal cash outlays are substantial, the analysis here uses the total EPF cash transfer to the provinces for 1977-1978 deflated to reflect that amount which would have been paid to the provinces in 1976-1977 had the EPF legislation been in effect one year earlier, i.e. the base year for the paper.

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(7)Source for all EPF information is the Department of Finance, Federal-Provincial Relations Division.

The federal cash transfer for these three established programs is allocated on the basis of the distribution which existed in 1976. Hospital insurance accounts for approximately one-half of the total transfer, medical care for one-third, and post-secondary education for one-sixth. This does not allow for varying rates of growth of each program which will undoubtedly occur over the next 50 years.

The proportion of the costs of hospital insurance and medical care have been allocated among the three major age groups in relation to their utilization of these services, as based on 1973 provincial data. All federal post-secondary education expenditures are assumed to be directed toward those aged 15 to 29 with an appropriate adjustment made to divide costs as between the youth and working-age population. The bilingualism development program is also included as an education expenditure directed towards the 15 to 64 age group.

Under the EPF formula, federal per capita costs associated with these three programs escalate with the growth of national income. The two cases adopted in this study of 1 and 2% annual growth in national income, therefore, make provision for an associated increase in the per capita costs of these programs. This is an exception to the general assumption that per capita program costs do not increase in line with economic growth.

2. Provincial and Municipal Expenditures. Hospital and medical care expenditures at the provincial and municipal levels have been developed applying the same distributions by age group as for federal health programs.

Elementary and secondary education expenses of the provinces have been allocated entirely toward the 0 to 17 age group. Total provincial post-secondary and other education costs including retraining are assumed to be directed toward those in the 18 to 64 age group, with an appropriate allocation between youth and the working-age population.

All municipal education expenses are assumed to be directed toward the 0 to 17 age group.

B. Major Transfer Programs

1. Federal.

a) Family Allowance Payments. FA payments are directed toward the 0 to 17 age group.

b) Old Age Security and Guaranteed Income Supplement. Expenditures for OAS and GIS are allocated to the 65+ age group since the age of entitlement is 65. (Corresponding provincial programs are not included.)

c) Spouse's Allowance (SPA). Expenditures for this program are directed toward the 60 to 64 age group.

d) Canada Assistance Plan (CAP). There are six programs under CAP, namely, general assistance, homes for special care, child welfare, health care, welfare services and work activity Part III. The distribution of expenditures by age group has been based on figures for 1975-1976 and applied to 1976-1977 costs, as more fully illustrated by data contained in Section VII.

2. Provincial and Municipal. All provincial and municipal welfare expenditures have been allocated on the basis of the distribution for federal CAP expenditures.

C. Labour, Manpower and Immigration, and Solicitor General Expenditures

Federal expenditures for both Labour and Manpower and Immigration (now Canada Employment and Immigration Commission) are directed toward the 18 to 64 age group. The Government Annuities Program, a federal expenditure administered by the Unemployment Insurance Commission (UIC), has been treated in a separate fashion whereby forecasts of actual expenditures for each year are added to federal totals calculated as in Section II. This approach has been adopted because of the phasing out of this program. The predicted program expenditures, directed towards the 65+ age group, have been provided by the Annuities Branch, UIC.

D. Veterans Affairs Expenditures

As in the case of the Government Annuities Program, Veterans Affairs actual expenditure forecasts for each year have been added to total federal expenditures.

E. Canada Pension Plan and Quebec Pension Plan

Although financed by compulsory contributions rather than funds from general revenue, the CPP is included in this study because it is an age-specific expenditure with important implications for future taxpayers.

Since the CPP is a program which has not yet reached maturity and whose growth depends on parameters such as average wages and salaries (AWS) - which, in turn, are related to economic growth - it is unrealistic to calculate its per capita cost in the manner described in Section I. Instead, the Department of Insurance has provided simulations of projected total expenditures (based on similar assumptions concerning population, inflation rates and national income) which have been re-grouped by age to form three sub-programs - CPP 1, CPP 2 and CPP 3.

CPP expenditures made on behalf of the young (CPP 1) are those for children of disabled contributors, orphans' benefits, and death benefits. Disability pensions and 50% of the widow's/widower's pensions are assumed to be expenditures made on behalf of the 15 to 64 age group (CPP 2). Those aged 65 and over are eligible to receive a pension from CPP if they have contributed to the plan. This part of CPP expenditures and 50% of the widow's/widower's pensions are included as expenditures for the 65+ group (CPP 3).

To incorporate CPP into the non-growth case, it has been necessary to estimate per capita costs for CPP 1, CPP 2 and CPP 3 using expenditure information for the years 1991-2011, by which time CPP will have reached maturity.

Allowance for the QPP has been made by applying the all-Canada population to the CPP model.

IV. RESULTS

The results presented here include, for each level of government, the age-specific expenditure trends for the projections of both population growth and non-growth as well as the relative 'burden' which these expenditures will impose on those of labour force age in terms of the share of national income they represent under three scenarios of economic growth.

As indicated earlier, the total per capita cost for each age group has been applied to two basic types of population projections: the first, referred to as the growth case, allows for changes in both the absolute size and age structure of the population; the second, referred to as the non-growth case, applies the changing age structure to a fixed 1976 population. For convenience, those 0 to 17 years of age are designated as Group 1, those 18 to 64 as Group 2, and those 65 and over as Group 3.

The data that follow are drawn from more detailed tables in Section VI, which indicate the pattern of change over the period 1976-2031. Generally speaking, the most marked changes in expenditure trends and the resulting burden occur after the turn of the century.

A. Federal Perspective

1. Expenditure Trends. On the assumption that most per capita levels of program expenditures other than those for the C/QPP, health and post-secondary education are frozen at their current levels, federal age-specific expenditures in 1976 and 2031 would vary in 1976 dollars and as a percentage of the total as shown in Table 2. For purposes of this calculation, both the CPP and QPP have been included in the federal sector.

Table 2

Federal Age-Specific Expenditures by Groups, 1976-2031, Assuming Population Growth and Non-Growth, in Billions of 1976 Dollars and as Percentage of Total

Group	Age	Population 1976		Growth Case 2031		Non-Growth Case 1976		Non-Growth Case 2031	
		$	%	$	%	$	%	$	%
1	0-17	3.0	18.8	3.2	7.4	3.3	16.8	2.1	7.8
2	18-64	6.1	38.4	10.2	23.6	6.7	34.6	6.4	23.1
3	65+	6.8	42.8	29.8	69.0	9.4	48.6	19.1	69.1
Total$		15.9		43.3		19.4		27.6	

Note: Differences between expenditure data for 1976 here, as well as in Table 8, reflect the assumption in the non-growth cases of C/QPP benefit payments at the levels which would have been in effect if the YMPE had reached 1 times AWS.

As shown in the detailed data contained in Section VI, changes in total federal expenditures under the two population cases do not form a smooth progression. For example, total federal age-specific expenditures under the growth case rise rapidly until 1991, rise more slowly until around 2006, and begin to increase more quickly thereafter.

Table 2 shows that in the population growth case, expenditures allocated to Groups 1 and 2 decline significantly during the period as a percentage of the total, while Group 3 expenditures rise sharply. Of the $27 billion increase in the total, 84% is accounted for by expenditures related to the elderly.

In the non-growth case, the pattern of change in the distribution of expenditures as between the different age groups is very similar in percentage terms. Total age-specific expenditures at the federal level increase by only $8.2 billion in this case, however, because increased expenditures on the elderly are more than offset by declining expenditures related to the other two age groups.

The implications of the redistribution of federal expenditures on the basis of age structure changes alone are substantial. If the age structure of the year 2031 had existed in 1976, federal age-specific expenditures would have been approximately 42% higher. In the growth case increase to 2031, the age structure component accounts for approximately 42% of the increase and the absolute growth component accounts for approximately 58%.

2. The Burden - Federal.

Table 3

Estimated Federal Age-Specific Expenditures, 1976-2031, as a Percentage of Net National Income

		Annual Per Capita Growth Rate of Net National Income		
	1976	2031		
		0%	1%	2%
Total burden	7.7	17.0	12.3	9.4
Old age burden	4.8	14.0	9.9	8.0

a) Total Burden. As shown in Table 3, if per capita national income remains constant, the total federal age-specific burden, including C/QPP, increases from 7.7% of Net National Income in 1976 to 17% in 2031. But the share of NNI required to be allocated to such expenditures declines to 12.3% by 2031 if annual growth in per capita national income averages 1% and to 9.4% if it averages 2%. This assumes that, with the exceptions previously noted, the per capita level of service in real terms remains unchanged from that provided in 1976.

b) Old Age Burden. Trends in the federal old age burden are similar to, but more pronounced than, those trends in the federal total burden.

In terms of constant per capita national income, the old age burden increases at a declining rate from 4.8% in 1976 until the end of the century, and then accelerates. By 2031 the burden reaches 14% - nearly three times its 1976 level.

When per capita national income grows at a real rate of 1 or 2% annually, and program services are held at 1976 levels, the federal old age burden increases respectively to 9.9 and 8% of Net National Income by 2031.

B. Provincial Perspective

1. Expenditure Trends. The impact of demography on provincial age-specific expenditures between 1976 and 2031, as shown in Table 4, is more moderate than was shown for the federal government and the C/QPP.

Table 4

Provincial Age-Specific Expenditures by Groups, 1976-2031, Assuming Population Growth and Non-Growth, in Billions of 1976 Dollars and as a Percentage of Total

Group	Age	Population Growth Case				Non-Growth Case			
		1976		2031		1976		2031	
		$	%	$	%	$	%	$	%
1	0-17	8.0	45.2	7.8	31.3	8.0	45.2	5.3	31.3
2	18-65	7.5	42.1	9.7	38.7	7.5	42.1	6.5	38.7
3	65+	2.3	12.8	7.5	30.0	2.3	12.8	5.1	30.0
Total$		17.8		25.0		17.8		16.9	

In the population growth case, provincial Group 1 expenditures remain at about the same level throughout the period in dollar terms, but they decline from 45% of total provincial age-specific expenditures in 1976 to 31% in 2031. Group 2 expenditures increase but account for only 39% of total age-specific expenditures in 2031, compared with 42% in 1976. Group 3 expenditures rise sharply in absolute dollars and as a proportion of total age-specific expenditures. The percentage of total age-specific expenditures accounted for by Group 3 increases from 13% in 1976 to 30% in 2031. Of the $7 billion increase in total age-specific expenditures, 30% accrues to Group 2 and 73% to Group 3.

When the changing age distribution alone is applied to the 1976 population, total provincial age-specific expenditures decrease gradually from $17.8 billion until 2011 and then increase to $16.9 billion. Since the population distribution is common to both the growth and the non-growth cases, the relative sizes of the group expenditures are identical. The increase in Group 3 expenditures of $2.8 billion is more than offset by the $3.7 billion decrease in the expenditures of both Groups 1 and 2.

2. The Burden.

a) Total Burden. Table 5 indicates that when per capita national income is held constant, the total provincial age-specific burden decreases from 9.4% of NNI in 1976 to 8.7% in 2031.

When real per capita national income grows at an annual rate of 1%, and program services are held at 1976 levels, the provincial burden decreases to 5% in 2031. It declines to 2.9% of Net National Income with growth of 2%.

b) Old Age Burden. In the case of constant per capita national income, the provincial old age burden increases from 1.6% in 1976 to 3.5% in 2031, more than twice its 1976 level.

Table 5

Estimated Provincial Age-Specific Expenditures, 1976-2031, as a Percentage of Net National Income

		Annual Per Capita Growth of Net National Income		
	1976	2031		
		0%	1%	2%
Total burden	9.4	8.7	5.0	2.9
Old age burden	1.6	3.5	2.0	1.2

When real per capita national income grows at a rate of 1% annually, and program services are held at 1976 levels, the provincial old age burden increases to 2% in 2031, an increase of 25%. However, when real per capita national income expands at an annual rate of 2%, the provincial old age burden declines moderately to 1.2% in 2031.

C. Municipal Perspective

1. Expenditure Trends.

Table 6

Municipal Age-Specific Expenditures by Groups, 1976-2031, Assuming Population Growth and Non-Growth, in Billions of 1976 Dollars and as a Percentage of Total

Group	Age	Population Growth Case				Non-Growth Case			
		1976		2031		1976		2031	
		$	%	$	%	$	%	$	%
1	0-17	2.8	78.0	2.7	60.7	2.8	78.0	1.9	60.7
2	18-64	0.5	13.2	0.7	15.9	0.5	13.2	0.5	15.8
3	65+	0.3	8.8	1.1	23.4	0.3	8.8	0.7	23.4
Total$		3.6		4.5		3.6		3.1	

In the population growth case, as shown in Table 6 total municipal age-specific expenditures increase from $3.6 billion in 1976 to $4.5 billion in 2031. Group 1 expenditures remain relatively constant over the time period in question, but drop from 78% of total municipal age-specific expenditures in 1976 to 61% in 2031. Group 2 expenditures increase during the period from $0.5 billion to $0.7 billion, their percentage of total municipal age-specific expenditures rising from 13 to 16%. Group 3 expenditures increase from $0.3 billion in 1976 to $1.1 billion in 2031. The percentage of total municipal age-specific expenditures accounted for by Group 3 increases from 9% in 1976 to 23% in 2031. Of the $0.9 billion increase in total municipal age-specific expenditures from 1976-2031, 27% accrues to Group 2 and 82% to Group 3.

When the age distribution for 2031 is applied to the 1976 population, total municipal age-specific expenditures decrease from \$3.6 billion to \$3.1 billion. The increase in Group 3 expenditures of \$0.4 billion is more than offset by the decrease of \$0.9 billion in expenditures on Group 1, resulting in an overall decrease of \$0.6 billion in total expenditures.

2. The Burden.

Table 7

Estimated Municipal Age-Specific Expenditures, 1976-2031, as a Percentage of Net National Income

		Annual Per Capita Growth of Net National Income		
	1976	2031		
		0%	1%	2%
Total burden	2.2	1.8	1.0	0.6
Old age burden	0.2	0.5	0.3	0.2

a) Total Burden. Table 7 shows that when per capita national income is held constant, the municipal total age-specific burden imposed on the support group decreases from 2.2% in 1976 to 1.8% in 2031.

When real per capita national income grows at an annual rate of either 1 or 2%, and program services are held at 1976 levels, this burden decreases to 1.0 and 0.6% respectively in 2031.

b) Old Age Burden. In the case of constant per capita national income, the municipal old age burden increases from 0.2% in 1976 to 0.5% in 2031.

When real per capita national income grows at an rate of either 1 or 2% annually, and program services are held at 1976 levels, the changes in the municipal old age burden between 1976 and 2031 are fractional.

D. All Levels of Government

The results for both expenditure trends and burden calculations in respect of all federal, provincial and municipal age-specific programs are shown in Tables 8 and 9.

1. Expenditure Trends.

Table 8

All Government Age-Specific Expenditures by Groups, 1976-2031, Assuming Population Growth and Non-Growth, in Billions of 1976 Dollars and as a Percentage of Total

Group	Age	Population Growth Case				Non-Growth Case			
		1976		2031		1976		2031	
		$	%	$	%(1)	$	%	$	%
1	0-17	13.9	37.1	13.8	19.0	14.1	34.6	9.3	19.6
2	18-64	14.1	37.7	20.6	28.3	14.7	36.0	13.4	28.2
3	65 +	9.4	25.2	38.4	52.7	12.0	29.4	24.8	52.3
Total$		37.3		72.8		40.8		47.5	

(1)Fractional differences in the percentage distribution in the growth and non-growth cases are due to rounding.

In the population growth case, total age-specific expenditures increase between 1976 and 2031 from $37 billion to $73 billion. Group 1 expenditures remain relatively stable at $14 billion but drop from 37% of total age-specific expenditures in 1976 to 19% in 2031. Group 2 expenditures increase from $14 billion in 1976 to $21 billion in 2031, but their share in total age-specific expenditures decreases from 38 to 28%. Group 3 expenditures increase from $9 billion in 1976 to $38 billion in 2031. The percentage of total age-specific expenditures accounted for by Group 3 increases from 25% in 1976 to 53% in 2031. Of the $35 billion increase in total age-specific expenditures from 1976 to 2031, 18% accrues to Group 2 and 82% to Group 3.

When the changing age distribution is applied to the 1976 population, as shown in the non-growth case, total age-specific expenditures increase from $41 billion in 1976 to $48 billion in 2031. Since the population distribution is common to both the growth and non-growth cases, the relative sizes of the group expenditures are similar to the population growth case. The increase in total age-specific expenditures of $6.7 billion is less than the Group 3 expenditure increase of $12.8 billion because of decreases totaling $6.1 billion in Groups 1 and 2.

The implications of the redistribution of the three levels of governmental expenditures on the basis of age structure changes alone are not as substantial as in the federal perspective; if the age structure projected for 2031 had existed in 1976, total government age-specific expenditures would have been only approximately 16% higher, but federal expenditures would have been up by 42%.

2. The Burden.

a) Total Burden. Table 9 indicates that when per capita national income is held constant, the burden of age-specific expenditures of all levels of government increases from 19.2% in 1976 to 27.4% in 2031. Most of the increase occurs after 2011.

When real per capita national income grows at an annual rate of 1%, and program services are held at 1976 levels, the total burden declines moderately to 18.4% by 2031.

When real per capita national income grows at an annual rate of 2%, the burden declines from 19.2% in 1976 to 13.0% in 2031.

Table 9

Estimated All Government Age-Specific Expenditures, 1976-2031, as a Percentage of Net National Income

		Annual Per Capita Growth of Net National Income		
	1976	2031		
		0%	1%	2%
Total burden	19.2	27.4	18.4	13.0
Old age burden	6.6	18.0	12.2	9.3

b) Old Age Burden. The burden of specific expenditures on the aged by all levels of government increases from 1976 to 2031 in each of the cases shown.

In the case of constant per capita national income, the burden almost triples, rising from 6.6% of Net National Income in 1976 to 18% in 2031.

When real per capita national income grows at a rate of 1 or 2% annually, the burden increases to 12.2 and 9.3% respectively in 2031, with most of the increase occurring after 2011.

As in the case of the old age burden of federal age-specific expenditures, implications of the rising aged-dependency ratio are serious when no growth of real per capita income is considered over time. Again, however, when real growth is introduced into the analysis of the burdens, the provision to the aged, at 1976 levels, of the services examined in this paper presents less serious expenditure implications. In contrast to the 43% increase in the burden of total age-specific expenditures by all levels of government in the non-growth case, the total would decline slightly in terms of national income if there were average annual economic growth of 1% and substantially if there were growth of 2%. The old age burden reflects similar results, since in the zero growth case it increases by 172% of its 1976 level, whereas in the 1 and 2% growth cases, it increases by only 85 and 41% respectively.

Taking into account all levels of government, the increasing old age burden is offset by the decreasing burden associated with the young to a much greater extent than in the federal case. For example, in the event of average annual economic growth per capita of 2%, the total age-specific burden of all levels of government as a proportion of Net National Income would decline by 32% between 1976 and 2031, while the federal burden would increase by 22%. In these same circumstances, the old age burden of all levels of government would increase by 41%, but that of the federal government alone would rise by 67%.

It should be recalled that the population projection used in this study incorporates a relatively low fertility rate assumption, the effect of which is to generate a population with fewer young in the total population. As a result, the calculated burdens, to the extent there is a bias, will be overstated. On the other hand no provision is made, in respect of most programs, for the added costs of the programs likely to be associated with economy-wide increases in productivity.

V. CONCLUSIONS

This study has focused on the impact of changes in the size and distribution of the population under different conditions of economic growth on the age-specific expenditures of all three levels of government. It is not intended to provide a forecast of actual government expenditures in the future, but only to provide a basis for consideration of the possible effects of changes in the size and structure of the population over time.

The main conclusions that emerge from this analysis are as follows:

- the costs of maintaining existing health, social, educational and other similar services for the benefit of the young and the elderly at the levels existing in 1976 could increase substantially in the absence of real economic growth per capita. The same holds true if increases in real growth are matched by increases in the real level of services provided to the dependent proportion of the population on a per capita basis; and

- the cost implications of maintaining these services at 1976 levels on a per capita basis would become progressively less serious to the extent that there is an increase in real per capita economic growth over the years to 2031. Indeed, upon examination of expenditures of all three levels of government expenditures taken as a group, the total burden remains virtually constant in the 1% real growth case. In the 2% case it actually decreases.

VI. AGE-SPECIFIC GOVERNMENT EXPENDITURES AND RELATIVE BURDEN FOR SELECTED YEARS BETWEEN 1976 AND 2031

Tables 10 through 21 provide the data, at 5-year intervals, underlying Section IV.

Table 10

Total Federal Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars
Projected Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	2.98	18.78	6.10	38.44	6.80	42.85	15.87
1981	2.90	15.36	7.05	37.34	8.92	47.25	18.88
1986	2.92	13.59	7.70	35.83	10.87	50.58	21.49
1991	3.06	12.80	8.03	33.58	12.82	53.62	23.91
1996	3.16	12.23	8.35	32.33	14.32	55.44	25.83
2001	3.15	11.50	8.93	32.60	15.31	55.90	27.39
2006	3.12	10.83	9.57	33.23	16.11	55.94	28.80
2011	3.13	10.17	10.01	32.51	17.65	57.32	30.79
2016	3.18	9.46	10.19	30.32	20.24	60.22	33.61
2021	3.20	8.69	10.23	27.78	23.39	63.51	36.83
2026	3.24	8.12	10.18	25.53	26.45	66.32	39.88
2031	3.22	7.44	10.20	23.57	29.84	68.96	43.27

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 11

Total Federal Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, 1976 Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	3.26	16.84	6.70	34.59	9.41	48.58	19.37
1981	2.89	14.38	7.01	34.83	10.23	50.79	20.14
1986	2.72	13.19	7.05	34.21	10.84	52.60	20.60
1991	2.67	12.71	6.85	32.60	11.49	54.69	21.00
1996	2.61	12.36	6.72	31.85	11.77	55.79	21.09
2001	2.48	11.79	6.81	32.32	11.77	55.89	21.05
2006	2.35	11.18	6.95	33.08	11.72	55.73	21.02
2011	2.27	10.53	6.97	32.28	12.35	57.19	21.59
2016	2.24	9.80	6.83	29.91	13.77	60.29	22.83
2021	2.21	9.02	6.65	27.12	15.65	63.85	24.51
2026	2.18	8.28	6.48	24.63	17.66	67.10	26.32
2031	2.15	7.79	6.36	23.07	19.06	69.14	27.57

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 12

Burdens Imposed on Labour Force by Federal Age-Specific Expenditures
Canada, 1976-2031

	1976	1981	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031
1. Total Burden												
(a) Zero growth(1)	0.077	0.084	0.090	0.097	0.102	0.103	0.103	0.108	0.120	0.136	0.152	0.170
(b) 1% growth	0.077	0.081	0.083	0.088	0.089	0.087	0.085	0.086	0.095	0.105	0.115	0.123
(c) 2% growth	0.077	0.077	0.078	0.079	0.078	0.075	0.072	0.073	0.078	0.085	0.091	0.094
2. Old Age Burden												
(a) Zero growth	0.048	0.056	0.063	0.070	0.075	0.076	0.076	0.081	0.093	0.108	0.123	0.140
(b) 1% growth	0.048	0.054	0.058	0.063	0.065	0.064	0.063	0.065	0.073	0.083	0.092	0.099
(c) 2% growth	0.048	0.051	0.053	0.056	0.057	0.055	0.052	0.054	0.059	0.066	0.072	0.080

(1)Growth rates refer to the annual real growth of per capita national income (based on 18-64 age group).

Table 13

Total Provincial Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, Projected Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	8.05	45.17	7.50	42.06	2.27	12.77	17.82
1981	7.61	40.91	8.36	44.95	2.63	14.14	18.60
1986	7.61	39.29	8.79	45.38	2.97	15.33	19.37
1991	7.89	39.33	8.78	43.77	3.39	16.90	20.06
1996	8.06	39.26	8.78	42.77	3.69	17.97	20.53
2001	7.96	37.77	9.19	43.66	3.90	18.53	21.05
2006	7.79	36.11	9.70	44.97	4.08	18.92	21.57
2011	7.76	34.97	9.95	44.84	4.48	20.19	22.19
2016	7.83	34.19	9.91	43.28	5.16	22.53	22.90
2021	7.89	33.33	9.77	41.28	6.00	25.35	23.67
2026	7.88	32.17	9.69	39.66	6.87	28.12	24.43
2031	7.83	31.33	9.67	38.70	7.49	29.97	24.99

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 14

Total Provincial Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, 1976 Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	8.05	45.17	7.50	42.06	2.27	12.77	17.82
1981	7.14	40.92	7.85	44.96	2.46	14.12	17.46
1986	6.71	39.27	7.75.	45.39	2.62	15.34	17.08
1991	6.59	39.35	7.33	43.76	2.83	16.88	16.74
1996	6.44	39.26	7.01	42.75	2.95	17.99	16.39
2001	6.12	37.80	7.07	43.66	3.00	18.54	16.20
2006	5.80	36.12	7.23	44.97	3.04	18.91	16.07
2011	5.61	34.95	7.20	44.85	3.24	20.20	16.05
2016	5.52	34.20	6.99	43.26	3.64	22.54	16.15
2021	5.46	33.34	6.76	41.30	4.15	25.36	16.38
2026	5.37	32.23	6.61	39.64	4.69	28.13	16.68
2031	5.30	31.34	6.54	38.70	5.07	29.96	16.91

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 15

Burdens Imposed on Labour Force by Provincial Age-Specific Expenditures
Canada, 1976-2031

	1976	1981	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031
1. Total Burden												
(a) Zero growth(1)	0.094	0.086	0.081	0.080	0.077	0.074	0.072	0.072	0.074	0.078	0.083	0.087
(b) 1% growth	0.094	0.082	0.074	0.069	0.063	0.058	0.053	0.051	0.050	0.050	0.051	0.050
(c) 2% growth	0.094	0.078	0.067	0.059	0.052	0.045	0.040	0.036	0.034	0.032	0.031	0.029
2. Old Age Burden												
(a) Zero growth	0.016	0.016	0.017	0.018	0.019	0.019	0.019	0.020	0.023	0.027	0.032	0.035
(b) 1% growth	0.016	0.016	0.015	0.016	0.016	0.015	0.014	0.014	0.016	0.017	0.019	0.020
(c) 2% growth	0.016	0.015	0.014	0.014	0.013	0.012	0.011	0.010	0.011	0.011	0.012	0.012

(1)Growth rates refer to the annual real growth of per capita national income (based on 18-64 age group).

Table 16

Total Municipal Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, Projected Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	2.83	77.96	0.48	13.22	0.32	8.82	3.64
1981	2.67	74.37	0.54	15.32	0.37	10.31	3.59
1986	2.67	72.55	0.58	16.03	0.42	11.41	3.68
1991	2.77	71.58	0.61	16.02	0.48	12.40	3.87
1996	2.83	70.75	0.64	16.25	0.52	13.00	4.00
2001	2.80	69.48	0.68	16.87	0.55	13.65	4.03
2006	2.74	67.99	0.71	17.62	0.58	14.39	4.03
2011	2.73	66.75	0.73	17.85	0.64	15.40	4.10
2016	2.75	65.17	0.74	17.54	0.73	17.30	4.22
2021	2.77	63.53	0.73	16.74	0.85	19.50	4.36
2021	2.77	61.97	0.72	16.11	0.97	21.92	4.47
2031	2.75	60.71	0.72	15.89	1.06	23.40	4.53

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 17

Total Municipal Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, 1976 Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	2.83	77.96	0.48	13.22	0.32	8.82	3.64
1981	2.51	74.57	0.51	15.04	0.35	10.38	3.37
1986	2.36	72.65	0.52	15.89	0.37	11.45	3.24
1991	2.31	71.70	0.51	15.89	0.40	12.41	3.23
1996	2.26	70.81	0.51	16.10	0.42	13.09	3.19
2001	2.15	69.41	0.52	16.85	0.43	13.73	3.10
2006	2.04	67.94	0.53	17.71	0.43	14.35	3.00
2011	1.97	66.55	0.53	17.94	0.46	15.51	2.96
2016	1.94	65.16	0.52	17.52	0.52	17.33	2.98
2021	1.92	63.62	0.51	16.85	0.59	19.53	3.02
2026	1.89	61.96	0.49	16.22	0.67	21.82	3.05
2031	1.86	60.74	0.49	15.83	0.72	23.43	3.07

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 18

Burdens Imposed on Labour Force by Municipal Age-Specific Expenditures
Canada, 1976-2031

	1976	1981	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031
1. Total Burden												
(a) Zero growth(1)	0.022	0.019	0.018	0.018	0.017	0.017	0.016	0.015	0.016	0.017	0.017	0.018
(b) 1% growth	0.022	0.018	0.016	0.015	0.014	0.013	0.012	0.011	0.011	0.011	0.011	0.010
(c) 2% growth	0.022	0.017	0.015	0.013	0.012	0.010	0.009	0.008	0.007	0.007	0.006	0.006
2. Old Age Burden												
(a) Zero growth	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.005
(b) 1% growth	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003
(c) 2% growth	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002

(1)Growth rates refer to the annual real growth of per capita national income (based on 18-64 age group).

Table 19

All Levels of Government: Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, Projected Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	13.86	37.13	14.07	37.69	9.39	25.15	37.33
1981	13.19	32.12	15.95	38.85	11.92	29.03	41.06
1986	13.21	29.65	17.08	38.34	14.26	32.01	44.55
1991	13.73	28.71	17.42	36.42	16.69	34.89	47.83
1996	14.05	27.90	17.78	35.31	18.53	36.80	50.36
2001	13.91	26.51	18.80	35.83	19.76	37.66	52.47
2006	13.65	25.09	19.99	36.74	20.77	38.17	54.41
2011	13.61	23.84	20.70	36.26	22.77	39.89	57.08
2016	13.76	22.66	20.84	34.32	26.13	43.03	60.73
2021	13.87	21.39	20.74	31.98	30.24	46.63	64.85
2026	13.89	20.19	20.59	29.94	34.30	49.87	68.78
2031	13.81	18.97	20.59	28.29	38.40	52.75	72.79

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 20

All Levels of Government: Age-Specific Expenditures by Group, 1976-2031, in Billions of 1976 Dollars, 1976 Population

Year	Group 1(1)		Group 2(1)		Group 3(1)		Total Expenditure
	$ expenditure	% total	$ expenditure	% total	$ expenditure	% total	
1976	14.14	34.63	14.68	35.95	12.01	29.41	40.83
1981	12.55	30.64	15.37	37.52	13.04	31.84	40.96
1986	11.78	28.79	15.31	37.42	13.83	33.79	40.92
1991	11.57	28.24	14.69	35.84	14.71	35.91	40.97
1996	11.31	27.79	14.24	35.00	15.14	37.20	40.68
2001	10.76	26.66	14.40	35.69	15.20	37.66	40.35
2006	10.19	25.42	14.71	36.70	15.19	37.88	40.09
2011	9.85	24.27	14.70	36.20	16.05	39.53	40.60
2016	9.70	23.12	14.34	34.17	17.92	42.71	41.97
2021	9.59	21.84	13.92	31.71	20.39	46.45	43.91
2026	9.44	20.51	13.59	29.51	23.01	49.98	46.04
2031	9.31	19.58	13.39	28.16	24.85	52.26	47.54

(1)Group 1: 0-17 years, Group 2: 18-64 years, Group 3: 65+ years.

Table 21

All Levels of Government: Burdens Imposed on Labour Force by Age-Specific Expenditures
Canada, 1976-2031

	1976	1981	1986	1991	1996	2001	2006	2011	2016	2021	2026	2031
1. Total Burden												
(a) Zero growth(1)	0.192	0.189	0.189	0.195	0.197	0.193	0.190	0.195	0.210	0.230	0.253	0.274
(b) 1% growth	0.192	0.180	0.173	0.171	0.166	0.158	0.150	0.149	0.155	0.166	0.176	0.184
(c) 2% growth	0.192	0.172	0.159	0.151	0.142	0.130	0.120	0.116	0.119	0.124	0.128	0.130
2. Old Age Burden												
(a) Zero growth	0.066	0.075	0.082	0.092	0.097	0.098	0.098	0.105	0.119	0.139	0.160	0.180
(b) 1% growth	0.066	0.071	0.076	0.081	0.083	0.081	0.079	0.082	0.091	0.103	0.114	0.122
(c) 2% growth	0.066	0.068	0.069	0.072	0.071	0.068	0.064	0.065	0.071	0.079	0.086	0.093

(1)Growth rates refer to the annual real growth of per capita national income (based on 18-64 age group).

VII. BASE DATA ON GOVERNMENT AGE-SPECIFIC EXPENDITURES, 1976-1977

Table 22 outlines the statistical data on age-specific expenditures by the three levels of government for 1976-1977 which provided the base for subsequent calculations with respect to the possible impact of changing population patterns on future expenditures under varying assumptions about economic growth and two different postulations regarding future population size. As indicated previously, these base figures were subsequently adjusted to take account of the somewhat different population groupings adopted for purposes of the analysis undertaken in this appendix and the body of the report.

Table 22

Adjusted Federal, Provincial and Municipal Program Expenditures, 1976-1977

Programs	Federal	Provincial	Municipal	Total	Age Group
	Expenditure ($ Millions)				
Health Care					
a) Hospitalization	1,355.6	4,097.1	662.1	6,114.8	
(i) H1	140.1	423.5	68.5	632.12	0-14
(ii) H2	711.2	2,149.5	347.3	3,207.87	15-64
(iii) H3	504.3	1,524.1	246.3	2,274.7	≥65
b) Medical care	452.8	1,966.4	3.1	2,422.3	
(i) M1	74.7	324.5	0.5	399.7	0-14
(ii) M2	316.5	1,374.5	2.2	1,693.2	15-64
(iii) M3	61.5	267.4	0.4	329.4	≥65
Inçome Security and Social Assistance					
a) Family allowance	2,013.3	179.0	-	2,192.3	0-17
b) GIS(1)	1,051.9	-	-	1,051.9	≥65
c) Spouse's allowance	100.0	-	-	100.0	60-64
d) OAS	3,354.3	-	-	3,354.3	≥65
e) CAP	1,303.7	2,133.8	334.8	3,772.3	
(i) CAP1	291.8	478.0	75.0	844.8	0-14
(ii) CAP2	715.8	1,171.5	183.8	2,071.1	15-64
(iii) CAP3	296.1	484.4	76.0	856.5	≥65
Labour	31.5	-	-	31.5	15-64
Manpower and Immigration					
a) Development and utilization of manpower	781.8	-	-	781.8	15-64
b) UIC	1,700.0	-	-	1,700.0	15-64
Education	1,030.8	9,446.0	2,635.0	13,111.8	
(i) E1	128.0	6,206.0	2,635.0	8,969.0	0-17
(ii) E2	902.8	3,056.0	-	3,958.8	15-29
(iii) E3	-	184.0	-	184.0	15-64

Table 22 (Cont'd)

Programs	Federal	Provincial	Municipal	Total	Age Group
	Expenditure ($ Millions)				
Solicitor General	701.0	-	-	701.0	15-64
(i) SOL GEN1	492.1	-	-	492.1	15-29
(ii) SOL GEN2	208.0	-	-	208.0	30-64
Programs Accorded Special Treatment					
Canadian Government Annuities	95.0	-	-	95.0	
Veterans Affairs	762.8	-	-	762.8	
Total age-specific expenditure excluding C/QPP	14,734.5	17,822.3	3,635.0	36,191.8	
C/QPP	1,148.4(2)				

(1)Provincial income-tested programs for the elderly amounting in 1976 to about $200 millions are not included.

(2)For purposes of this analysis, both CPP and QPP expenditures have been included under federal programs.

APPENDIX 17

THE IMPACT ON PROVINCIAL TREASURIES AND ON CAPITAL MARKETS FOR PROVINCIAL, MUNICIPAL AND CORPORATE SECURITIES OF INVESTING CPP FUNDS THROUGH FINANCIAL MARKETS

E. Bower Carty*

Chapter XIII of the Task Force report included an examination of possible future financing arrangements for the Canada Pension Plan (CPP) as it is currently structured. It outlined various considerations that could bear on government policy and illustrated the prospective size of the CPP fund under different financing policies and assumptions (see Tables XIII-3 and XIII-5). Because the CPP fund could become very large in these circumstances, the report suggested that government policy should also be directed at allocating at least a portion of the CPP funds through financial markets and described several institutional arrangements that could be adopted to achieve this objective.

This appendix examines the initial impact of the proposal on treasuries and on capital markets for provincial, municipal and corporate securities. The examination is not extended to second round effects.

The analysis is developed on the basis of the CPP fund resulting from the application of the 'equitable' contribution rates shown in Table XIII-3 of the report and on an assumed inflation-adjusted rate of investment return of 3.5%. The size of the CPP fund is postulated for a number of years over the 1976-2025 period, both in 1976 dollars and in current dollars. Table 1, which reproduces Table XIII-4 of the report, illustrates the amount of CPP funds that would flow automatically to the provinces, and the amount that would be cycled through financial markets, under each of two separate scenarios described below.(1)

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*Task Force on Retirement Income Policy. Department of Finance. This appendix draws heavily on work done within the Capital Markets Division of the Department of Finance.

(1)The data are not carried forward beyond 2025, after which time the fund as illustrated would begin to become depleted. Given the number of economic and demographic assumptions which must be made, it is realistic to expect that even within a period of 50 years, adjustments to the contribution rate would be made, as necessary, to respond to unfolding reality.

Table 1

Cumulative Amount of Funds Available for CPP Lending Directly to Provinces and for Market Investment under Two Scenarios
($ billion)

Year End	CPP Fund 1976$	CPP Fund current $	Scenario 1 Direct to Provinces (current $)	Scenario 1 Through Market (current $)	Scenario 2 Direct to Provinces (current $)	Scenario 2 Through Market (current $)
1976	11	11	11	-	11	-
1981	17	20	20	-	20	-
1986	30	42	22	20	27	15
1991	46	74	22	52	38	36
1996	62	116	22	94	53	63
2001	79	173	22	151	73	100
2011	118	347	22	325	137	210
2021	143	562	22	540	257	305
2025	139	616	22	594	330	286
2025(1)	(398)	(1,766)	(22)	(1,744)	(191)	(1,575)

(1)The contribution rates used in preceding lines were premised on an inflation-adjusted rate of investment return of 3 1/2%. With rates of return of 2%, rather than 3 1/2%, data for 2025 would be as shown in brackets. Because of the lower rates of return in this case, contribution rates must be higher and the fund must be larger. Under Scenario 2, with an inflation-adjusted rate of return of 2%, the funds allocated directly to provinces would also be smaller ($191 million in 2025) than if the rate of return had been 3 1/2% ($330 million), since the advances necessary to finance interest on provincial borrowings would be smaller. (A 45% CPP with the Year's Maximum Pensionable Earnings (YMPE) set at 1.5 times average wages and salaries (AWS), as provided for in Option 4, phased in over ten years, would lead at times, under a comparably established (notionally equitable) contribution rate structure, to funds more than twice as large as those shown. Under the scenarios described, all of the increase would be placed through the market.)

Under Scenario 1, the provinces would continue to borrow directly from the CPP the funds that were available until benefit payments and administrative expenses became equal to contributions based on the current contribution rate of 3.6%. It is now estimated that this will occur in 1983. In that year, the net amount of funds available for lending to the provinces would equal the amount of interest payable by them to the CPP on outstanding loans. Under this scenario, the provinces would not be required to repay principal, but they would be required to pay interest on outstanding loans each year. The amount of funds held by the CPP would continue to grow, however, as a result both of the interest receipts and of the increases in contribution rates that have been postulated. These additional funds would all be invested through

financial markets (and some, of course, might be invested in the publicly-issued securities of provincial governments). Table 1 shows that under Scenario 1, investment through the capital markets would reach an estimated $594 million in 2025, about 27 times the $22 million invested directly in provincial securities.

Under Scenario 2, the same situation would prevail up to 1983 as that described under the first scenario. But in order to avoid any reverse cash flow from the provinces to the CPP following 1983, the interest payable by the provinces on outstanding CPP loans would be added to their debt. This would result, in effect, in a continuing increase in direct borrowings by the provinces from the CPP fund.(2) The remaining funds available, however, would be invested through the capital market. Under this scenario, over the period illustrated the cumulative amounts invested through financial markets and the amounts loaned directly to the provinces would be of roughly similar magnitudes.

To illustrate the enormous economic significance of the CPP fund, it is estimated that by 2025 it would total $616 billion, an amount equivalent to about:

- 121% of the Canadian dollar assets of chartered banks and of near-banks; or
- 142% of the Canadian dollar assets of life insurance companies; or
- 152% of the Canadian dollar assets of trusteed pension plans; or
- 17% of all outstanding Canadian bonds and stocks

if the growth of these institutions and instruments parallels that of Gross National Product (GNP). What would be the impact of investing CPP funds through capital markets under the two scenarios outlined above? To illustrate the possible impact, the CPP funds invested through financial markets are assumed to be allocated in the same proportions as were the assets of private trusteed pension plans at the end of 1976. The analysis below looks specifically at the effects on markets for (1) debt of provinces and local governments, and (2) corporate bonds and equities. There would also be effects on the markets for other instruments, particularly mortgages.(3)

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(2)It may be noted, incidentally, that under Scenario 2, direct lending to provinces by the early 2020s would exceed the growth in the fund, necessitating a withdrawal of some of the funds invested through the market. The $54 billion growth of the CPP fund from $562 billion in 2021 to $616 billion in 2025 would be less than the amount of $73 billion represented by direct borrowings by the provinces to cover interest. Withdrawals of funds invested through the market would accelerate rapidly thereafter. In fact, loans to the provinces under this scenario are a logical absurdity - an "investment" on which, in perpetuity, the investor receives payment of neither interest nor principal.

(3)Apart from the areas of investment covered specifically in the analysis below, private trusteed plans had 3% of their assets in federal bonds, 21.1% in mortgages and guaranteed funds and 12.5% in other forms.

1. Effects on Provinces and on the Capital Market for Provincial and Local Government Securities. Annual borrowing requirements of provincial and local governments and their enterprises, based simply on historical averages, have been estimated at 4.5% of GNP. Since for the most part only the borrowing requirements of provinces other than Quebec are relevant to the recycling of CPP funds, it is assumed - again based on historical averages - that 70% of the provincial/local borrowings are by provinces other than Quebec. Direct borrowing from the CPP under either scenario would meet only a small proportion of total requirements, as shown in Table 2. It is likely then that the provinces would actively compete with other borrowers for that portion of CPP funds that would be made available through the market.(4)

In 1976, 9.5% of the assets of private trusteed pension plans took the form of provincial and municipal bonds.(5) If it were assumed that the CPP funds placed through the market would result in a similarly structured portfolio, then 9.5% of such funds would flow to provincial and municipal governments.

The annual flows of funds from the CPP to provinces and local governments are shown in Columns (2) and (3) for Scenario 1 and in Columns (3) and (4) for Scenario 2. Total net purchases by the CPP of provincial and local bonds as a percentage of total provincial and local borrowing are shown for the two different scenarios in Columns (4) and (7) of the table.

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(4)The analysis on which the numbers in Table 2 are based assumes that the availability of CPP funds to the provinces does not affect the levels of either their tax revenues or their expenditures. Thus, funds supplied directly by the CPP are assumed to lower by equivalent amounts borrowing requirements from other sources.

(5)It could be argued that this figure would have been substantially higher if the provinces had not had available CPP-source funds.

Table 2

Annual Provincial and Local Borrowing from CPP under Two CPP Funding Scenarios (excludes Quebec)

		Scenario 1			Scenario 2		
Year	(1) Total Prov.& Local Borrowing	(2) Obtained Directly	(3) Obtained Through Market	(4) % Total Borrowing (2)+(3)as % of (1)	(5) Obtained Directly	(6) Obtained Through Market	(7) % Total Borrowing (5)+(6)as % of (1)
	($ billion)			%	($ billion)		%
1976	8	1.5	0	20	1.5	0	20
1981	10	1.6	0.1	18	1.6	0.1	18
1986	14	0	0.5	4	1.8	0.3	16
1991	19	0	0.7	4	2.5	0.4	16
1996	25	0	0.9	4	3.3	0.6	15
2001	34	0	1.2	4	4.4	0.8	15
2011	60	0	1.6	3	8.3	0.8	15
2021	98	0	2.0	2	15.7	0.5	17
2025	117	0	0.9	1	20.2	-1.0	16
2025(1)	(117)	(0)	(8.4)	(7)	(9.1)	(7.6)	(14)

(1)Figures in brackets illustrate a CPP fund based on inflation-adjusted rates of investment return of 2% rather than 3 1/2%.

Under the assumptions made about the portfolio structure, it is clear that the CPP would remain a significant, although not a dominant, lender for provincial/local bonds under Scenario 2. The proportion of funds provided by the CPP would fall from the current level of 20% to around 15% by the turn of the century and then rise very slightly. Under Scenario 1, the CPP's role would remain significant for a decade, but then diminish greatly, declining to 1% of total provincial/local borrowing in 2025. (If the CPP investment profile were to more closely resemble that of public than trusteed pension plans, investing proportionately greater amounts in government securities, it would be a dominant lender in these markets.)

2. Effects on Capital Markets for Corporate Securities. At the end of 1976, 21.3 and 32.6% of the assets of private sector trusteed pension plans - based on book values - were invested in corporate bonds and equities, respectively. What would the effect on the corporate bond and equity markets be if funds of the magnitude outlined in Table 2 were channelled to the capital market and if the above noted proportions were invested in corporate bonds and equities? Table 3 illustrates CPP purchases of corporate bonds and equities in selected years under these circumstances.

Table 3

Net New Corporate Financing Provided Annually from CPP under Two CPP Funding Scenarios

		Net Acquisitions by CPP			
		Scenario 1		Scenario 2	
Year	Net New Issues in $ Billion	$ Billion	% of Net New Issues	$ Billion	% of Net New Issues
Corporate Bonds					
1976	4	0	0	0	0
1981	6	0.3	5	0.3	5
1986	9	1.2	13	0.8	9
1991	12	1.5	13	1.0	8
1996	16	2.0	13	1.3	8
2001	22	2.7	12	1.8	8
2011	38	3.6	9	1.8	5
2021	63	4.5	7	1.2	2
2025	76	2.1	3	-2.1	-3
2025(1)	(76)	(18.9)	(25)	(17.0)	(22)
Corporate Equities					
1976	1	0	0	0	0
1981	2	0.5	30	0.5	30
1986	2	1.8	72	1.2	48
1991	3	2.3	70	1.5	45
1996	5	3.1	69	2.1	45
2001	6	4.1	68	2.7	44
2011	11	5.5	52	2.8	26
2021	18	6.9	39	1.8	10
2025	21	3.2	15	-3.4	-16
2025(1)	(21)	(29.0)	(138)	(26.0)	(124)

(1)Figures in brackets illustrate a CPP fund based on inflation-adjusted rates of investment return of 2% rather than 3 1/2%.

Based on the admittedly static assumption underlying the preceding discussion, CPP funds under either scenario would become a major element in the market for corporate securities - subject to whatever depressing influence on discretionary personal saving might arise from an expansion of the CPP. Indeed, under both scenarios they would seem destined to overwhelm equity markets for a period of 30 to 40 years, raising questions about the appropriateness of this degree of government influence and concentration in the private sector.

Under the circumstances, it is likely that smaller amounts of CPP funds would find their way to the corporate markets than shown in Table 3 and larger proportions would be allocated to finance provincial and local governments than indicated in Table 2. This could reduce considerably the magnitude of potential problems. Table 4 combines Tables 2 and 3, showing the overall effect in respect of net new issues of provincial, local and corporate securities as a group. It will be seen for example, that under Scenario 2, with an inflation-adjusted return of 3 1/2% the CPP would absorb no more than 10% of the net new issues of provincial and local governments (excluding the province of Quebec and non-market issues of the CPP to other provinces), and of corporations. Moreover, it should not be overlooked that this analysis has presupposed no growth in capital markets relative to GNP and the possibility exists that a greater supply of financing seeking an outlet in the market might lead to a larger market.

Table 4

Net New Provincial, Local and Corporate Financing
Provided Annually from CPP under Two CPP Funding Scenarios
(excludes Quebec)

	Net Market Acquisitions by CPP			
	Scenario 1		Scenario 2	
Year	$ Billion	% of Net New Issues(1)	$ Billion	% of Net New Issues(1)
1976	0	0	0	0
1981	1.0	6	1.0	6
1986	3.5	14	2.3	10
1991	4.6	13	3.0	9
1996	6.1	13	4.0	9
2001	8.1	13	5.3	9
2011	10.7	10	5.5	5
2021	13.4	8	3.5	2
2025	6.3	3	-6.5	-3
2025(2)	(56.3)	(26)	(50.5)	(25)

(1)Excluding non-market acquisitions of provincial debt by the CPP as specified under the scenarios.
(2)Figures in brackets illustrate a CPP fund based on inflation-adjusted rates of investment return of 2% rather than 3 1/2%.

Nevertheless, concerns might arise over the possible disruption of specific markets where CPP transactions could exercise a dominating influence and over the resulting effect this could have on interest rates and on government stabilization policies. On the other hand, it can be argued that the use of market forces, even if it should prove necessary from time to time to constrain them, would yield more optimal results than the present investment arrangements.

Perhaps it is only realistic to note that governments are unlikely to be able to divorce themselves entirely from the responsibilities involved in the distribution of public pension fund assets - responsibilities inherent in the selection both of the options to be followed and of those to whom responsibility is entrusted. Limits to the scale on which CPP funds may effectively be invested through the capital market may constitute an important reason for avoiding the adoption of contribution rates that would provide in future for the full funding of the CPP, since such a course would produce a substantially greater accumulation of funds for investment by the CPP in one way or another than the amounts generated under the more modest assumptions about contribution levels adopted for purposes of this analysis. But those limits do not mean that the advantages of placing part of the funds through the market should be totally forgone.

In summary, under its present benefit structure the CPP fund which would be generated if the contribution rate moved over a 20-year period to its full cost level (assuming an inflation-adjusted rate of return of 3 1/2%) would be large enough to raise some doubts as to the feasibility of investing all or a substantial portion of it through the capital market without necessitating considerable adjustment in the market and involving significant concentrations of ownership. The assumption of an inflation-adjusted rate of return of 2% rather than 3 1/2%, or the adoption of Option 4 as described in Chapter X, would further enlarge the fund. The advantages of the allocation process of the market may accordingly need to be confined to that portion of the funds becoming available that can be absorbed by the market and the private sector without undue stress.

APPENDIX 18

SAVING FOR RETIREMENT - HOW MUCH IS REQUIRED?

Michael C. Wolfson*

A. Introduction

The purpose of this appendix is first to estimate the amount of saving that an age cohort would be required to do during its working years in order to maintain pre-retirement living standards after retirement, and second to determine the influence of particular factors on this amount of required saving.

The analysis generally abstracts from the particular institutional forms this saving takes, for example, whether it is by means of public sector programs like the Canada Pension Plan (CPP) and Old Age Security (OAS), or by individuals' saving through private pension plans. However, pooling of mortality risks is assumed. The analysis is based on a simple life cycle model of an age cohort. The cohort enters the labour force, works at an average wage, saves a portion of these earnings, and then after retirement draws upon these savings to finance its consumption. The main question is what fraction of earnings the cohort needs to set aside in order that post-retirement consumption levels are the same as average pre-retirement consumption. It is assumed that there are no inter-generational transfers. Thus, the cohort's saving must exactly pay for its post-retirement consumption. Furthermore, intra-cohort redistribution will be ignored; only cohort-wide averages will be considered.

Three important results emerge from this simplified analysis. First, with currently anticipated mortality experience, and assuming retirement is at age 65, an adequate retirement income system - one in which pre-retirement living standards or consumption levels were maintained after retirement - would require about 15% of earnings during working years to be saved. Second, this figure is highly sensitive to the age of retirement. For example, retirement at age 60 rather than age 65 would require a saving rate closer to 20%. Third, historical changes since 1920, particularly in the average age of entry to the labour force and in mortality rates, have served almost to double required saving rates. Also, the results are sensitive to discounting and interest rate assumptions.

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* Department of Finance. The assistance of E. Chow of the Treasury Board Secretariat is gratefully acknowledged. Responsibility for the paper rests with the author.

The analysis begins with the specification of a simple model of the lifecycle consumption of an age cohort. Then, the sources of data and parameters of the model are described. Finally, a range of simulation results are presented and discussed. The main focus in these simulations is on the sensitivity of the saving rate required to maintain living standards to alternative demographic and economic assumptions.

B. Model

The model abstracts from all institutional structure such as government, financial intermediaries, and the family. Essentially, the model is defined by two basic conditions. First, pre-retirement savings must exactly equal post-retirement consumption in financial or present value terms. Second, a condition of "continuity of consumption" or "maintenance of living standards" (the terms are used interchangeably) is imposed so that average pre-retirement consumption equals average post-retirement consumption in subjective or individual utility terms. These conditions can be formalized using of the following variables:

Let w_a = average per capita wages for individuals age a at the present time

p_a = proportion of the cohort surviving to age a

s = required saving rate out of wages

j = age of entry to the labour force

k = age of retirement

n = age at death of the last surviving member of the cohort

g_w = annual real growth rate of average wages

g_c = annual real growth rate of average post-retirement consumption

c_k = average per capita consumption in the first year of retirement (year k)

r = real social rate of return on savings, or the real/physical rate of inter-temporal transformation available to the cohort

d = real subjective discount rate

Then $w_a(1+g_w)^a$ = the average wage that a member of the cohort can expect to have when he or she is age a

$p_a w_a(1+g_w)^a$ = aggregate wages of the cohort when its members are age a

For convenience, let $c_o = c_k(1+g_c)^{-k}$

The financial condition that aggregate pre-retirement savings must equal aggregate post-retirement consumption in present value terms is then

(1) $S = \Sigma_{a=j}^{k-1} s\, p_a w_a (1+g_w)^a (1+r)^{-a}$

= present discounted value of total pre-retirement saving

(2) $C = \Sigma_{a=k}^{n} p_a c_o (1+g_c)^a (1+r)^{-a}$

= present discounted value of total post-retirement consumption

(3) $S = C$

While the financial condition above is conceptually straightforward, the "maintenance of living standards" condition is not. A range of definitions are possible. The basic definition that will be used is the following:

(4) $c_{pre} = (1/(k-j))\, \Sigma_{a=j}^{k-1} (1-s)\, w_a (1+g_w)^a (1+d)^{-a}$

= average pre-retirement consumption or living standard

(5) $c_{post} = c_o(1+g_c)^k (1+d)^{-k}$

= representative post-retirement consumption or living standard

(6) $c_{pre} = c_{post}$

(The actual formulae used in the model are somewhat more complex because the wage rates and population figures (w_a and p_a) are based on data disaggregated by sex, and because the age figures (j, k, and n) need not be integers.)

Equation (4) defines average per capita pre-retirement living standards as the present subjectively discounted value of actual average per capita wages less saving.(1) As a special case, when $d=g_w$ (4) is equivalent to the "updated career average" earnings base used by the C/QPP (ignoring the drop-out provisions).

Equation (5) defines representative post-retirement living standards simply as the present subjectively discounted value of actual consumption in the first year after retirement. However, when $d=g_c$ (5) is also the present subjectively discounted value of average consumption throughout the retirement period.

Note that Equations (4) and (5) ignore the proportions of the cohort surviving to various ages (p_a). In effect, the maintenance of living standards condition is being applied on an individual basis to those members of the cohort who are assumed to survive at least one year into retirement. Alternatively, at the beginning of their "lives", members of the cohort want to choose a pattern of saving that will maintain their pre-retirement living standards on the assumption that they will in fact live past retirement age, even though they know that some will die before that time. The parameters c_o and g_c plus the maintenance of living standards condition effectively determine the basic level of pensions in the first year of retirement and how they are indexed subsequently.

It should be noted that the "updated career average" earnings defined in equation (4) need not equal earnings in the year immediately preceding retirement. Thus, maintenance of living standards as defined in equations (4) to (6) may in fact imply an increase or a decrease in consumption immediately following retirement. Alternative definitions of maintenance of living standards could use analogues of "final average" or "best average" earnings as the basis for average pre-retirement consumption. In these cases, for example, the summation in (4) would run over only the last five years or the best ten years rather than over the entire pre-retirement period.

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(1)"Subjectivity" enters through the discount parameter d. Other than this discounting, an extra unit of consumption adds the same amount to an individual's living standards or well-being independently of the age at which the marginal unit of consumption is being added or of the initial amounts of consumption (both at the given age and at other ages) to which it is added (i.e. marginal utility is assumed to be constant and the utility function is assumed to be inter-temporally additively separable). It may be noted that these are strong and probably unrealistic assumptions regarding the way individuals evaluate alternative prospective consumption streams. Nevertheless, such assumptions are analytically convenient; they make the results easier to understand; and the alternative of specifying a "more reasonable" inter-temporal utility function would raise many other controversial questions.

Since family structures are ignored, no explicit account is being taken of survivorship provisions. However, equation (5) is generally equivalent to assuming a 50% survivorship provision. This occurs because maintenance of living standards is defined on a per capita basis. Thus, if one spouse of a couple dies, the other spouse is assumed to continue consuming at half the rate of the couple. (Note that this is not meant to imply that 50% survivorship provisions are necessarily adequate.)

Equations (1) to (6) thus constitute the basic model for the cohort. The age specific pattern of wages (w_a) will be data input to the model; the surviving members of the cohort (p_a) as well as j, k, and n will constitute the demographic parameters; while g_w, g_c, r, and d will be the economic parameters of the model. This leaves s and c_o as the two unknowns which can be determined from the model's two basic equations (3) and (6), though s is the variable of primary interest.

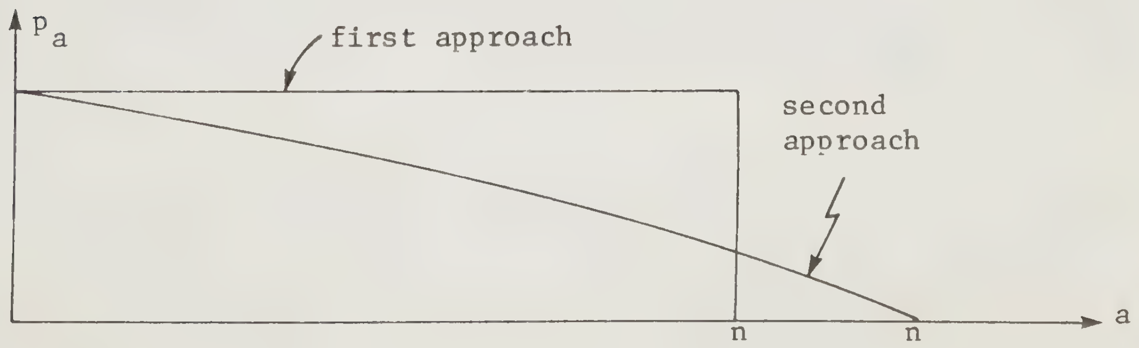
C. Approaches

Two basic approaches have been used for generating simulation results due to limitations on available data, particularly with respect to expected participation in the labour force (parameters j and k). The first approach is more simplified but is able to draw upon historical series on average ages at entry to and retirement from the labour force, and average life expectancies determined in an analogous manner. In the second approach, more detailed mortality data have been coupled with arbitrary labour force assumptions. Thus, in the first approach the focus will be on historical changes in labour force patterns while in the second approach the focus is on other parameters of the model.

D. Mortality Rates and Life Expectancies

The first approach, in the case of population and mortality data (p_a and n), involves a very simplified mortality assumption. Essentially, everyone in the cohort is assumed to live exactly their life expectancy at "birth". To model this assumption, the parameter n is set at the desired life expectancy and p_a is set equal to one for $j \leq a \leq n$. In this way, approximate results can be obtained without data on age- (and sex-) specific mortality rates. Under the second approach, detailed mortality rate data are used to generate the p_a; and n is no longer important since it is set at the age of the oldest surviving member of the cohort. These two approaches are illustrated in Figure 1.

Figure 1 Cohort Size (p_a) as a Function of Age (a)



Two sets of mortality data have been used corresponding to the two approaches mentioned above. The first set consists simply of the life expectancies of males age 15 for the census years from 1921 to 1971. These life expectancies are shown in the third column of Table 2. These are stationary expectancies as described below. The second set of mortality data consists of actual age- and sex-specific mortality rates for 1971 and projected rates for 2050 as were used in the CPP Actuarial Report Number 6.(2) These mortality rates for selected ages are displayed in Table 1 along with the implied proportions of the population surviving to these selected ages. (Note that the initial size of the cohort at age 18 is assumed to be 1.00 consisting of .50 males and .50 females.) Thus, for example, 157 out of every 10,000 males age 18 in 1971 died, and of the .5000 males alive at age 18 the mortality rates imply that .4901 will survive to age 30.(3)

Table 1

Mortality Rates and Proportions of Cohort Surviving at Selected Ages Based on Current and Projected Mortality Rates Used in CPP Actuarial Report No. 6, 1978

	Males				Females			
	Mortality Rates		Proportion Surviving		Mortality Rates		Proportion Surviving	
Age	1971	2050	1971	2050	1971	2050	1971	2050
18	.00157	.00164	.5000	.5000	.00056	.00043	.5000	.5000
20	.00178	.00189	.4984	.4983	.00056	.00044	.4994	.4996
30	.00152	.00153	.4901	.4893	.00076	.00052	.4964	.4972
40	.00291	.00240	.4807	.4808	.00173	.00119	.4909	.4936
50	.00761	.00569	.4590	.4642	.00402	.00275	.4783	.4848
60	.01917	.01459	.4068	.4244	.00932	.00712	.4500	.4639
70	.04435	.03251	.3027	.3440	.02337	.01558	.3891	.4227
80	.09701	.07847	.1549	.2042	.06513	.04316	.2623	.3200
90	.20983	.14765	.0335	.0665	.17136	.11748	.0851	.1553
100	.41969	.26257	.0010	.0060	.38255	.24024	.0043	.0221

(2)The mortality rates are unpublished data used for the Canada Pension Plan Statutory Actuarial Report No. 6 as at December 31, 1977; December 14, 1978; Department of Insurance, Ottawa.

(3)It may be noted that these mortality rates used by the Department of Insurance embody the assumption of increasing likelihood of death for males under age 30 between 1971 and 2050.

Table 2

Male Life and Working Life Expectancies at Age 15, Stationary Values 1921-1971

Year	Age at: Entry to Labour Force	Age at: Retirement	Age at: Death	Number of: Working Years	Number of: Retirement Years	Working Years Per Year of Retirement
1921	16.5	63.7	67.6	47.2	3.9	12.1
1931	17.0	64.0	68.4	47.0	4.4	10.7
1941	17.2	64.1	69.1	46.9	5.0	9.4
1951	17.5	63.9	70.4	46.4	6.5	7.1
1961	18.2	64.0	71.2	45.8	7.2	6.4
1971	19.8	63.3	71.3	43.5	8.0	5.4

E. Working Life Parameters

Corresponding to the two types of mortality data that have been used, two approaches have been used for the working life parameters j and k. In the first case of an historical set of life expectancies noted above, a set of labour force entry ages (j) and retirement ages (k) have been derived from data presented in Gnanasekaran and Montigny.(4) These expectancies are shown in the first two columns of Table 2 and they are computed in the same ways as the life expectancies in the third column. In fact, the life expectancies shown in Table 2 were chosen precisely because they corresponded to the labour force expectancies of Gnanasekaran and Montigny, which appear to be the only such Canadian data available.

It should be noted that these are all stationary expectancies. In other words, they are computed as if, in a given year, mortality and labour force participation rates in that year for males and females of all ages had not been and were not changing over time. In actual fact, a 15 year old male in 1921, when he is 25, will experience 1931 rather than 1921 mortality rates for 25 year old males. This longitudinal

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(4)These working life expectancies, as well as the first set of mortality data using simple life expectancies, are drawn from Table 12 in K.S. Gnanasekaran and G. Montigny; Working Life Tables for Males in Canada and Provinces, Statistics Canada no. 71-524E occasional. It may be noted that there are some errors in the figures in this table for 1971. Also, the estimates of the age of entry into the labour force (parameter j) have been derived by the author from other detailed data given in the publication.

aspect is not captured by stationary expectancies. Unfortunately, sufficient data are not available to compute, for example, the work life and life expectancies for males who were turning 65 in 1921 when they were age 15 (though non-stationary or longitudinal life expectancies are of course available for more recent years). To compute such expectancies would require age- and sex-specific mortality rates and labour force participation rates extending back to 1871. Similarly work life and life expectancies for males age 15 in 1971 that capture the longitudinal perspective require projections beyond 2050. For the purposes of this analysis, it is being assumed that the use of stationary expectancies is sufficient to indicate the general magnitude of the demographic and labour force changes, in the context of pension policy, that have been acting over the last half century. A measure of the importance of this assumption is noted in the discussion of the simulation results below (see footnote (8)).

As an initial indication of these working life and life expectancy changes, Table 2 shows that the (stationary) expected length of working life declined by almost four years from 47.2 years in 1921 to 43.5 years in 1971. Over the same period, the expected retirement period more than doubled to 8.0 years. As a consequence, the expected number of working years per year of retirement fell by over 50% from 12.1 in 1921 to 5.4 in 1971. These kinds of changes suggest that in order to maintain the same levels of consumption after retirement as during working years, the effort (i.e. saving) required during working years would have had to more than double. Indeed, this is the result that generally emerges from the simulation results presented below.

With the second set of mortality data described above (also stationary), data on age at entry to the labour force, retirement age, and life expectancy are not used. Instead, the working life is assumed to begin at age 18; the retirement age will be a parameter whose impact is to be studied; and life expectancy will be implicit in the population figures (p_a) being used.

F. Wage Data

Average wages for purposes of the model should be average wages for all members of an age group, whether they work or not. The reason, simply, is that an adequate retirement income system is assumed to provide coverage for homemakers and individuals who were unemployed for periods during their working age years. The starting point that has been used is the average earnings of CPP contributors in 1974 by age and sex, as shown in the first and second columns of Table 3.(5) Since these are average earnings for those who were working, they have been scaled down first by the labour force participation rates in the third and fourth columns, and then by the employment rates in the fifth and sixth columns.(6) These sex-specific expected wages were then combined with the population figures in Table 2 to obtain the average figures

(5) The earnings data are from Tables 13 and 14 in the report Canada Pension Plan Contributors, 1975; Health and Welfare Canada.

(6) The participation and employment rates are drawn from various longer-term projections.

that have been used for w_a.(7) The per capita wage figures w_a in turn represent the earnings base of the cohort, and are used both as the source of savings for retirement and for determining pre-retirement consumption (in equation (4) above).

Table 3

Average Wages, Participation Rates, and Employment Rates by Age and Sex

Age	Average Wages for Working Individuals		Participation Rates		Employment Rates	
	Males	Females	Males	Females	Males	Females
15-19	3,927	2,900	.93	.82	.89	.89
20-24	6,954	5,199	1.00	.82	.89	.89
25-29	10,410	6,578	1.00	.76	.96	.94
30-34	12,845	6,540	.99	.72	.96	.94
35-39	14,015	6,526	.99	.72	.96	.94
40-44	14,575	6,624	.96	.73	.96	.94
45-49	14,594	6,725	.96	.66	.96	.94
50-54	14,069	6,744	.93	.58	.96	.94
55-59	13,077	6,710	.89	.52	.96	.94
60-64	11,430	6,531	.79	.31	.96	.94
65-69	11,430	6,531	.40	.13	.96	.94

G. Economic Parameters

Three of the four economic parameters have been assigned a "base" value. However, in order to explore the impact of each of these parameters on required saving rates, "alternative" values will also be considered. Table 4 sets out these base and alternative values.

Table 4

Base and Alternative Values for Economic Parameters

Symbol	Parameter	Base Value(s)	Alternative Values
g_w	real growth rate of average wages (%)	2.0	1.5 2.5
r	real rate of return (%)	3.5	2.0, 5.0, 10.0
g_c	real growth rate of post-retirement consumption	0, g_w	-
d	real discount rate	g_w	0, r

(7)This procedure has only been used in conjunction with the second set of detailed age- and sex-specific mortality rates. For the first approach using the historical demographic data for males from Table 1, the wage data have simply been taken from the first column of Table 3.

The real growth rate of average wages (g_w) is assumed to be 2.0% per year, based on longer-term projections. However, alternative values of 1.5% and 2.5% will also be examined.

The long-run real rate of return (r) to be used in calculations such as this is a crucial parameter. A value of 3.5% per year appears reasonable for the real return on a mixed portfolio of shares, mortgages, and long-term government and high quality corporate debt. However, it is not clear that such a rate of return is the appropriate guide for the society-wide opportunities for transforming current into future output. For example, some recent studies have suggested that the real before-tax rate of return to private corporate capital in manufacturing may be as high as 10%. But the 10% before-tax figure is not necessarily appropriate because it does not take account of all the costs of production, for example tax revenues used to finance necessary productive infra-structure. In addition, many negative externalities such as pollution, congestion, and depletion of non-renewable resources are not being adequately valued in the calculations that produce such high rates of return. Other factors influencing the long-run rate of return that should be used for purposes of the model are the real rates of return in sectors other than private manufacturing such as services and the public sector, and rates of return for intangibles such as education. The basic assumption that will be used is that r is 3.5%, though 2.0%, 5.0%, and 10.0% will also be examined.

Two base assumptions for the growth rate of post-retirement consumption (g_c) will be examined. A growth rate of zero, since inflation is being ignored, is equivalent to having retirement benefits price indexed. The alternative is to assume that the rate of growth of consumption during retirement equals the rate of growth of wages (both per capita), in which case g_c will be set equal to g_w (whatever it happens to be).

The final parameter is the subjective real discount rate. This discount rate enters the model in two main ways. First, it is used in equation (4) in determining average pre-retirement living standards. Second, it is used in equation (5) to provide the link between average pre-retirement living standards and average living standards in the first year of retirement. The general premise in this analysis is that individuals want to maintain their living standards at a close to constant level over their lifetimes. However, this begs the question of what discount factor is appropriate for transforming dollar amounts of consumption in different time periods into equal living standards or equal levels of well-being.

Three assumptions will be considered. The first is a zero discount rate, corresponding to indifference between one dollar of real consumption today, and one dollar of real consumption next year. This discount rate implies that a person is equally happy with a price indexed retirement consumption stream throughout all the years of his retirement. Similarly, an individual whose wages over his working years fell in relation to average wages but kept up with prices would not consider himself to have been better off in his earlier as opposed to later working years. The second assumption is a discount rate equal to the rate of growth of wages (whatever it happens to be). In this case, the

discount rate corresponds to a "relative" basis for well-being: a person with consumption today equal to x% of the average wage would be equally happy with an amount of consumption next year that was also x% of the average wage at that time. Such a discount rate will be positive given the assumptions above (though not always in reality). Thus, an individual with these inter-temporal preferences would be progressively worse off if his post-retirement consumption were only price indexed, or his relative wage during his working years had been falling, while his level of well-being would be constant if his consumption maintained its relationship to average wages. The third discount rate assumption is that it is equal to the real rate of investment return after tax (whatever it happens to be). This discount rate implies that an individual is equally happy with a dollar's worth of consumption today, or what that dollar would buy a year from now if it had been invested at the going rate of interest. Equivalently, to maintain his level of well-being over time, an individual's consumption would have to grow at the after-tax rate of interest, possibly faster than both prices and average wages.

Much of mainstream economic theory employs this last discount rate as the true reflection of individuals' inter-temporal preferences, based as it is on the analysis of atomistic competitive market equilibria. However, it is not clear that this vantage is appropriate for collective decisions on the form of non-market institutions such as pension systems. First, individuals' inter-temporal preferences are undoubtedly heterogeneous. While market activities can accommodate this situation, collective pension arrangements must embody a single discount factor. Second, market interest rates (which one to choose?) reflect a myriad of factors in addition to individuals' inter-temporal preferences, not least of which are monetary and fiscal policy, firms' investment intentions, and international capital flows. Thus, market interest rates do not provide a clear guide to individuals' discount rates. Third, it is not even clear that individuals themselves behave as if they had a single discount rate. On the contrary, their behaviour is often inconsistent with such a notion. For example, individuals appear myopic when they show virtually no interest in indexed annuities when maturing their RRSPs. On the other hand, individuals apparently reflect a completely opposite preference when they show no interest in graduated payment mortgages. The implication of these points is that the age cohort setting out to plan its pension system cannot fall back on observed interest rates to provide a discount rate. Instead, a conscious, collective decision must be made.

For purposes of this analysis, the base assumption is that the growth rate of average wages would be chosen as the discount rate, though the other two possibilities will also be examined. This discount rate seems most appropriate on social policy grounds. If a zero real discount rate were chosen instead, the consumption levels of the given age cohort when it was in its retirement years would appear inadequate in reference to the consumption levels of subsequent age cohorts who were still in their working years, assuming poverty indices are determined on a relative basis. On the other hand, if some net of tax market rate of interest were chosen, the elderly could well be on average better off than those in subsequent age cohorts in any given year. Only by choosing the growth rate of average wages would the consumption levels of different age cohorts remain comparable.

It should be noted that the discussion above regarding the appropriate discount rate to be used for purposes of this analysis has no necessary connection to the choice of discount rate for purposes of evaluating public sector capital investments. This latter discount rate is related to questions of resource allocation. The former is related to notions of equity in the design of social programs.

H. Simulation Results

Tables 5 and 6 present the main simulation results. The upper part of Table 5 is based on the first approach using the simplified historical life and working life expectancies, while the lower part of Table 5 and all of Table 6 are based on the second approach. Table 5 uses the base values of the economic parameters. Table 6, on the other hand, explores the alternative values of the economic parameters. Following are the key points that emerge.

Table 5

Simulation Results for Alternative Labour Force and Demographic Data

Line Number	Year	Age at Entry to	Age at Retirement	Age at Death	Required Saving Rate for Pensions: Price Indexed	Required Saving Rate for Pensions: Wage Indexed
1	1921	16.5	63.7	67.6	6.6	7.0
2	1931	17.0	64.0	68.4	7.3	7.6
3	1941	17.2	64.1	69.1	8.0	8.4
4	1951	17.5	63.9	70.4	9.6	10.3
5	1961	18.2	64.0	71.2	10.5	11.2
6	1971	19.8	63.3	71.3	11.9	12.8
7	-	18	60	1971	17.7	20.7
8*	-	18	65	Mortality	12.8	14.8
9	-	18	70	Rates	8.5	9.7
10	-	18	60	2050	19.6	23.3
11	-	18	65	Mortality	14.7	17.3
12	-	18	70	Rates	10.4	12.0

* Same as line 7 in Table 6, base case simulation.

Assumptions: real rate of return - 3.5%; real growth rate of wages - 2.0%; real discount rate - 2.0%.

1. Historical Changes: The upper part of Table 5 shows the cohort's required saving rates in relation to the changing labour force and mortality experience of the last half century. For both price and wage indexed benefits, the "cost" of maintaining living standards through retirement has almost doubled, from under 7% in 1921 to 12-13% in 1971. While the results in the lower portion of the table are not strictly comparable with those in the upper part, comparison of lines 8 and 11

suggests that expected improvements in mortality to the year 2050 will raise required saving by about 2 percentage points from the 13-15% range to the 15-17% range (assuming 65 as the retirement age).(8)

2. Price Versus Wage Indexing. In lines 1 to 3 of Table 5, wage indexing implies a required saving rate only slightly higher than that required for price indexed retirement benefits (less than 0.4 percentage points higher). However, the relationship is not constant. In line 6, the difference has increased to just under one percentage point. In the lower part of the table, wage indexing requires a saving rate from 1 to 3 percentage points higher. The greater difference in the lower part of the table is due to the different way mortality has been treated. In line 6, no one dies until age 71, and no one lives past that age. Thus, there are nine years (from age 62.3 to age 71.3) for the difference between wage and price indexed benefits to be manifest. However, in line 8, some people die one year after retirement and others die twenty years after retirement. The use of a range of dates of death has an impact on the costs of wage indexing. Of course, the simulations in the lower part of the table are more realistic with respect to mortality.

3. Changes in Retirement Age. The lower part of Table 5 illustrates the potential impact of changes in the retirement age, holding other things fixed. Lowering the retirement age from 70 to 65 increases required saving by over half assuming 1971 mortality rates, by 4 to 5 percentage points. The increase is somewhat less than half using 2050 mortality rates. Lowering the retirement age from 65 to 60 again increases required saving, by a further 5 to 6 percentage points assuming either 1971 or 2050 mortality rates. Thus, changes in the retirement age can have a very strong impact on required saving rates.

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(8)It may be recalled that the 1971 and 2050 mortality rates are both stationary rates. The more appropriate longitudinal rates for 1971 lie between these two sets of rates. Thus, the simulations based on the 2050 rates provide an upper bound on the change that would occur if longitudinal rather than stationary rates for 1971 had been used.

Table 6

Sensitivity of Simulation Result to Alternative Economic Assumptions

Line Number	Real Rate of Return	Real Growth Rate of Wages	Real Discount Rate	Required Saving Rate for Pensions: Price Indexed	Wage Indexed
1	2.0	2.0	0.0	13.4	15.6
2			2.0	19.3	22.3
3	3.5	1.5	0.0	8.4	9.5
4			1.5	11.4	12.7
5			3.5	17.3	19.1
6	3.5	2.0	0.0	8.6	10.1
7*			2.0	12.8	14.8
8			3.5	17.3	19.9
9	3.5	2.5	0.0	8.9	10.7
10			2.5	14.2	17.0
11			3.5	17.3	20.6
12	5.0	2.0	0.0	5.4	6.3
13			2.0	8.1	9.4
14			5.0	15.7	17.9
15	10.0	2.0	0.0	1.0	1.1
16			2.0	1.5	1.7
17			10.0	11.8	13.2

* Same as line 8 in Table 5, base case simulation.

Assumptions: age at entry to labour force - 18; retirement age - 65; 1971 mortality rates.

4. Discount Rate. Turning to Table 6, it is evident that the higher the discount rate, the higher the required saving rate by a significant amount. For example, taking as the base case the simulation shown both in line 8 of Table 5 and in line 7 in Table 6 (marked by asterisks), choosing the rate of return rather than the growth rate of averages wages for the discount rate increases the required rate of saving by about five percentage points (line 8 versus 7). Alternatively, using a zero real discount rate would lower the required saving rate by about 4.5 percentage points (line 7 versus 6).

5. Rate of Return. Comparing lines 2, 7, 13, and 16 where the only difference is the rate of return, it is clear that required saving rates can be highly sensitive to the rate of return assumption. The required saving rates range from almost 20% when the real rate of return is 2% down to 1.5% when the rate of return is 10%. These results, however, are not so dramatic when the discount rate is kept equal to the rate of return (compare lines 2, 8, 14, and 17).

6. Growth Rate of Wages. Changes in the assumed growth rate of wages do not have a very strong effect on required saving rates, particularly when the discount rate is not varying as well (compare lines 3, 6, and 9 or lines 5, 8, and 11).

I. Conclusion

The main implication of the simulation results presented above is that with current demographic parameters, an adequate retirement income system based on collective saving would involve setting aside approximately 15% of earnings during working years.

APPENDIX 19

ESTIMATING THE REPLACEMENT INCOME AFTER RETIREMENT OF MIDDLE-INCOME PEOPLE NOW IN THE LABOUR FORCE

Alan Puttee*

A. Introduction

The report estimates that for one-earner couples of working age with incomes in the middle range to be more or less as well off in retirement as they were during their working years, an earnings-related pension plan replacing 40-45% of average (adjusted) lifetime earnings and covering earnings up to 1.5 times average wages and salaries (AWS) must be present, in addition to Old Age Security (OAS) benefits (see Chapter IV). As noted, this result takes account of the fact that many couples save enough in the pre-retirement period to own a mortgage-free home at retirement.

Tables IV-2 and IV-3 in the report contain estimates of the amount of replacement income that middle-income people now in the labour force may be expected to receive from earnings-related pension plans and from private saving. On the basis of these estimates, it was concluded that between one-third and one-half of middle-income people now in the labour force will receive income from earnings-related pension plans and private saving that will replace less than 35% of pre-retirement earnings. This in turn led to the conclusion that one-third to one-half of the middle-income group will encounter significant reductions in well-being upon retirement; that is, they will have replacement income well below the 40-45% levels noted above. The purpose of this appendix is to describe the derivation of Tables IV-2 and IV-3.

B. Table IV-2

Appendix 8 summarizes the results of a major study undertaken for the Task Force, the results of which are the basis for the estimates presented in Table IV-2. The study examines the effect of the coverage of the employer-sponsored pension system, the benefit formulae and vesting provisions of its plans and the mobility patterns of its members on the distribution of employer-sponsored pension income. Table 1 presents the results of two computer simulations that approximate the actual (average) characteristics of the existing employer-sponsored pension system.(1)

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* Task Force on Retirement Income Policy. Department of Finance.

(1) The complete study, Job Mobility and its Implications for the Employer-Sponsored Pension System in Canada, R. Préfontaine and Y. Balcer, (mimeo) is available on request from the Department of Finance. See Simulation No. 7.

Table 1

Estimated Amount of Replacement Income Generated for Males in Two Simulated Pension Systems(1)

Amount of Replacement Income	Percentage of Male Workers — Benefit Formulae: 1% Unit Benefit	2% Unit Benefit
	(%)	
Less than 25	76	56
25-29	6	6
30-34	6	3
35-39	5	5
40+	7	31
Total	100	100

(1)- Coverage: all full-time workers in public sector and half the full-time workers in private sector
- Vesting Provisions: 40 years of age and 5 years of service
- It is assumed that once vesting is achieved there are no cashouts.
- Deferred pensions in the public sector are assumed to be indexed to the Consumer Price Index (CPI) between termination and retirement; they are assumed to be unindexed in the private sector. Inflation is assumed to be 5% per annum.
- The pension benefit is based on final salary. Replacement income here equals pension income at age 65 divided by earnings at age 64. (Since the career earnings path underlying these data turns down towards the end of the career, this definition of replacement approximates that used elsewhere in this report.)
- The study on which the estimates are based took no account of the Canada and Quebec Pension Plans (C/QPP). If it is assumed that all employer-sponsored pension plans are perfectly integrated with the C/QPP, the above results can be thought of as including the replacement income arising from these plans. The C/QPP generates up to 25% replacement income for workers who are never members of employer-sponsored pension plans.

Note: Figures may not add due to rounding.

Table 1 indicates that, if recent Canadian labour mobility experience were maintained, and if all employer-sponsored pension plans had 1% unit benefit formulae (together with the other features detailed in the footnote to the table), over three-quarters of all males would receive pensions that replaced less than 25% of their pre-retirement earnings. Most of the rest would receive less than 40% replacement. The

2% unit benefit simulation indicates that, in such a system, almost one-third of male workers would receive 40% or higher replacement, although well over half would enter retirement with less than 25% replacement.

In preparing Table IV-2, these results were adjusted in two ways. Firstly, the results for the 1% and 2% unit benefit formulae were averaged. This implies that the employer-sponsored pension system, taken as a whole, has an average benefit formula equivalent to a 1.5% final salary plan. A study of the value of retirement pensions in Quebec found that "The average pension represents 1.33% of final pay for each credited year of service".(2) This suggests that the averaging procedure used here produces a result that is likely a fair approximation of reality. The second adjustment was designed to obtain results in respect only of middle-income workers (i.e. those having incomes in the middle 60% of the income range). This adjustment was done in a rough and ready way by assuming that 90% (10%) of low-income workers and 70% (30%) of high income workers had total replacement from earnings-related pensions of less than (more than) 35%. Since each of the low- and high-income groups constitutes 20% of the total, this assumption provides enough information to estimate the replacement results for middle-income people.

Table 2 reproduces Table IV-2 from the report which shows the effect of these two adjustments.

Table 2

Estimated Amount of Replacement Income to be Received by Middle-Income People from Employer-Sponsored Pension Plans and from the C/QPP

Amount of Replacement Income (%)	Percentage of Middle-Income Recipients	
Less than 25	63	
25-29	6	
30-34	4	31
35-39	6	
40+	21	
Total	100	

Three factors need to be taken into account in interpreting these results. Firstly, as Table 1 indicates, the job mobility study described above was confined to males. Since women appear to change their labour force status more frequently than men, a smaller proportion of their earnings is replaced by employer-sponsored pension plans. For this reason the results in Table 2 may be regarded as overestimates of the amount of replacement income the earnings-related pension system can be expected to produce. Since around 25% of all wages and salaries are earned by women the overestimate is likely significant.

(2) Les Régimes de Retraite au Québec. Les Cessations de Cotisation en 1973. Régie des Rentes du Québec. No. 3, October, 1976.

A second factor working in the opposite direction has already been mentioned. The results in Table 2 assume that all employer-sponsored pension plans are perfectly integrated with the C/QPP. In fact, in 1976, some 28% of members of employer-sponsored pension plans were in plans that were not integrated with the C/QPP - that is, where members will receive pensions in respect of the same earnings from both the public plans and the employer-sponsored plans. On this account, Table 2 underestimates the amount of replacement income that can be expected from earnings-related pension plans, both public and private. It should be noted, however, that as the C/QPP contribution rate is increased over time the proportion of members in unintegrated employer-sponsored pension plans will fall because many of these plans will be redesigned to avoid or minimize increases in total contribution rates.

A third factor is that the simulation study uses coverage ratios that somewhat overestimate the actual ratios. On this account Table 2 overestimates the level of replacement income expected to be produced by earnings-related pension plans.

As a result of these three factors, it seems likely that, on balance, Table 2 overestimates the amount of replacement income that middle-income workers can be expected to receive from earnings-related pension plans.

C. Table IV-3

Table IV-3 of the Task Force report provides an estimate of the amount of replacement income arising from private saving that middle-income people can be expected to have in retirement.

The estimate is based on saving data - Registered Retirement Savings Plan (RRSP) contributions and investment income reported on 1976 tax returns - together with estimates of the replacement income in retirement that the saving will produce for those reporting it.

Two main difficulties were encountered in this part of the analysis. The most important was the lack of information on RRSP accumulations; while information on annual contributions is available, given their tax-deductible status, no way was found to estimate satisfactorily the RRSP accumulations of particular groups of taxfilers. The second difficulty is a familiar one for those seeking to generate data relating to couples from an income tax system where returns are filed on an individual basis; given the time available, no way was found to match the income tax returns of married couples. It was decided to restrict the analysis to those taxfilers who claimed the married exemption in 1976; thus, the saving patterns of one-earner couples are taken as typical of those of single people and of two-earner couples.

For ease of analysis, the analysis was further confined to those who were in the 50 to 54 age group in 1976 (a group that spent virtually all of their working lives in an expanding economy unaffected by either depression or war). This simplification is based on the assumption

that the estimated replacement income this group will have in retirement is a good proxy for the replacement income that all those of working age with incomes in the middle ranges will have in retirement. This seems a reasonable assumption.

In 1976, 10 million people in the 20 to 64 age group filed an income tax return. Of these, some 856,000 were in the 50 to 54 age group chosen for examination. Some 274,000 taxfilers in this age group claimed the married exemption. Table 3 shows the income distribution of this group.

Table 3

Taxfilers Aged 50 to 54 Claiming Married Exemption, by Income Class, 1976

Income Class	Number of Filers (000)	%
0-$10,000	59.4	22
$10,000- 22,000	149.1	54
$22,000+	65.8	24
Total	274.2	100

Note: Numbers may not add due to rounding.

Since the analysis is concerned with the middle-income group (regarded as those comprising about the middle 60% of the total group), the analysis was focused on the 149,000 taxfilers who claimed the married exemption and who had incomes in the $10,000-22,000 range in 1976 (54% of the total group in Table 3).

The 1976 investment income position of the 149,000 middle-income taxpayers was used to estimate the replacement income they might be expected to receive in retirement.(3) Since the replacement income position of those of the group who contribute to RRSPs is likely to be better than those of the group who do not, the total group of 149,000 was divided into two groups, the first containing those who contributed little or nothing to RRSPs in 1976 (under $100), and the second containing those who contributed $100 and over. Table 4 sets out the basic data.

(3)Investment income includes income from dividends, interest, capital gains and other similar sources.

Table 4

Investment Income and RRSP Contributions of Middle-Income Taxfilers Aged 50 to 54 Claiming the Married Exemption, 1976

Part A

Income Class	All Filers (000)	% of All Filers with Investment Income of: 0-$100	$100-500	$500-1000	$1000-2000	$2000+
$10,000-14,000	50.1	22	5	2	2	2
$14,000-17,000	46.4	18	6	3	2	3
$17,000-22,000	52.6	15	7	4	5	3
Total	149.1	55	19	9	9	8

Part B

Income Class	% of All Filers with RRSP Contributions of Less than $100	% of All Filers with RRSP Contributions < $100 and with Investment Income of: 0-100	$100-500	$500-1000	$1000-2000	$2000+
$10,000-14,000	29	20	4	1	1	2
$14,000-17,000	25	16	4	2	1	2
$17,000-22,000	29	14	7	2	4	2
Total	84	50	16	6	6	6

Part C

Income Class	% of All Filers with RRSP Contributions of More than $100	% of All Filers with RRSP Contributions > $100 and with Investment Income of: 0-$100	$100-500	$500-1000	$1000-2000	$2000+
$10,000-22,000	16	5	3	3	3	2

Note: Numbers may not add due to rounding.

The analysis focuses on those in Part B of Table 4 - those whose RRSP contributions were small or zero in 1976. If it is assumed that the RRSP accumulations of this group are zero or very small, then the replacement income situation in retirement of this group can be estimated with reference only to the investment income information in the right hand part of the table. Using this assumption, the procedure adopted was as follows:

- the accumulated savings of those reporting investment income in 1976 were estimated by assuming that earnings of 8.75% were generated in that year;

- the group aged 50 to 54 in 1976 was assumed to enter retirement at the end of 1988; the growth of the 1976 stock of saving estimated above was then projected for the 12 years to 1988. Parallel assumptions were made with respect to the growth of earnings over the 12-year period(4) and;

- the accumulations available at retirement were converted into an annuity providing for a two-thirds continuance to the survivor. A 2% interest rate was used in the annuity calculation, so that the resulting annuities may be broadly thought of as being indexed to the CPI. Rates of replacement were calculated by dividing the annuity by the average earnings in the last three years of work.(5)(6)

Six factors need to be taken into account in assessing this procedure for estimating the replacement income that the private saving of middle-income people now in the labour force will produce in their retirement:

- the personal saving rate in recent years has been high in relation to the historical average;

- the procedure assumes that all savings accumulated by those in the 50 to 54 age group are to be used for retirement purposes;

- the group under examination is assumed to do no additional saving between 1976 and their retirement at the end of 1988;

- as noted above, it is assumed that those making a contribution of less than $100 to an RRSP in 1976 have small or zero RRSP accumulations;

- as noted above, the one-earner couple case is being taken as indicative of the replacement income position of all those in the middle-income group; and

- the procedure takes no account of savings accumulated in life insurance and in unincorporated businesses.

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(4)Over the 1977-1988 period the assumed annual rate of growth of the CPI and of earnings are 4.9% and 6.1% respectively. The assumed rate of return on private savings is 7.6%. As noted in the report, the relationship between these assumptions is more important than their levels. The assumed inflation-adjusted rate of return (some 2.6%) is lower than the 3.5% utilized elsewhere in the report. This reflects the assumption that those saving privately are likely to invest in bank deposits, savings bonds etc. - assets which, over the long run, attract a lower inflation-adjusted rate of return than do more diversified portfolios.

(5)This definition of replacement approximates that used elsewhere in the report.

(6)This procedure was carried out for each of ten income classes in the $10,000-22,000 range.

Given these factors, it is very likely that the procedure outlined above leads to an underestimate of the amount of replacement income that the savings of middle-income people now in the labour force will produce; all but the first two of the six listed factors work in this direction. To attempt to correct for this underestimation, the rates of replacement derived using the procedure outlined above were doubled. It is clear from this discussion that the estimates of the replacement income associated with private savings are quite crude; they are best regarded as 'ball park' estimates.

Table IV-3 in the report displays the estimates which include the doubling adjustment noted above; the table is reproduced below for reference.

Table 5

Estimated Amount of Replacement Income to be
Received by Middle-Income People from Private Savings

Amount of Replacement Income	Percentage of Middle-Income People	
(%)		
0	50	65
1 - 4	15	
5 - 14	9	
15+	10	
Unknown	16	
Total	100	

Table 5 indicates that fully half of those now in the middle-income group are expected to have zero replacement in retirement from private saving. Note that 16% of the group has an undetermined amount of replacement income. This group corresponds to those in Part C of Table 4 who contributed more than $100 to RRSPs in 1976; presumably among this group would be many who will receive significant levels of replacement from savings accumulated in RRSPs.

D. Conclusion

The results in Tables 2 and 5 (which reproduce Tables IV-2 and IV-3 in the report) can be recast as follows:

Percentage of Those in Middle Income Group
(%)

0 10 20 30 40 50 60 70 80 90 100

Estimated Replacement		
From Pensions	'Low' Pension (less than 30% replacement)	'High' Pension (30% replacement and over)
From Private Savings	'Low' Saving (less than 5% replacement)	'High' Saving (5% replacement and over)

The top bar shows, as does Table 2, that 69% of those now in the middle-income group are expected to receive less than 30% replacement from public and private earnings-related pensions. This has been arbitrarily classified as a 'low' pension. The remaining 31% of the middle-income group are expected to receive pensions that replace 30% or more of pre-retirement earnings - arbitrarily classified as a 'high' pension. The lower bar recasts Table 5 categorizing those with 'low' and 'high' saving according to whether the replacement from private savings is expected to be less or greater than 5%.

The total income replacement position of those now in the middle-income group will, of course, be dependent on the sum of the replacement available from the two sources shown. There is, however, no basis on which to estimate the pattern with which these two income sources will be held. The data do, though, allow for some rough estimates. Referring to the two bars above, it is, for example, possible that the 31% expected to have 'high' pensions and the 35% who are expected to have 'high' savings will be substantially the same group. In this extreme case, 65%, or almost two-thirds of the total middle-income group, will have both 'low' pensions and 'low' savings. As the bars show, a 'low' pension and 'low' saving together mean that less than 35% of pre-retirement earnings will be replaced. Since the maintenance of living standards requires 40-45% replacement, this case implies that some two-thirds of those now in middle-income groups will encounter significant reductions in living standards in retirement. The case at the other extreme will occur if all of those expected to have 'high' pensions have 'low' savings. In this event, 34% (65 minus 31) or about one-third of the group will have pensions and private saving that together replace less than 35% of pre-retirement earnings.(7)

(7) Since the estimates of replacement income arising from pension plans are thought to be somewhat high and since not all of the 'unknown' 16% in Table 5 can be expected to have total replacement income exceeding 35%, the 34-65% range may be somewhat low.

On the basis of the study on employer-sponsored pensions summarized in Appendix 8, and on the basis of estimates of the replacement income that will be generated from private saving, it is possible to estimate that between one-third and two-thirds of those now in middle-income groups will encounter significant reductions in levels of well-being when they retire. This result, which depends on some fairly crude estimates, is the basis for the estimate cited in the report that between one-third and one-half of those now in middle-income groups will encounter significant reductions in well-being in retirement.

APPENDIX 20

INFLATIONARY EARNINGS METHOD OF INDEXING PENSIONS

Hart D. Clark and Irwin Pressman*

A. The Inflationary Earnings Approach

Chapter IX of the Task Force report explored six alternative proposals for facilitating the maintenance of real pension values during periods of inflation. The first two alternatives involved the indexing of pensions to reflect the inflationary earnings of pension fund portfolios. Tables IX-1 and IX-2 gave examples of the results which might have been experienced under one method of applying this approach over the years 1962-1978, but details on the method of calculation were left to be provided in this appendix. The inflationary earnings approach described below is one of many possible approaches.

It will be recalled from the description of the inflationary earnings approach given in Chapter IX that the results shown in Tables IX-1 and IX-2 were based on experience under a mature pension plan. The inflationary earnings used were those attributable to assets whose value equalled the present value of the pensions-in-pay. The procedure was to use those inflationary earnings to cover the cost of a percentage increase in pensions each year up to the annual rate of increase in the Consumer Price Index (CPI) during the preceding year.

In years when the inflationary earnings were insufficient to pay for an increase in pensions equal to the percentage change in the CPI, a smaller increase was made, based on the amount of inflationary earnings available. In any such year, the pensioners who did not receive the full percentage increase in the CPI had a first claim on the inflationary earnings which became available in any subsequent year (unless the fund had an experience deficiency arising out of lower than expected investment return). For example, if the inflationary earnings were sufficient to pay for only a 1% increase in pensions in 1963 in respect of the CPI increase of 1.2% in 1962, an increase of the remaining 0.2% was made in 1964 or later in the pensions of the surviving pensioners from 1962 before any increase was made in respect of pensions-in-pay in 1963.

In a year when the inflationary earnings were more than enough to pay for the full percentage increase in the CPI in the preceding year, plus any shortfall from earlier years as described in the preceding paragraph, this excess was set aside, or 'banked', in the fund. The amount in the 'bank' together with the investment return on it was held for use in future years.

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In any year when the realized investment return on the pensioners' assets in the pension fund was less than the investment return required to maintain solvency at the non-inflationary rate (i.e. the valuation interest rate used for the pensioners' assets), an amount equal to this shortfall in the investment return was drawn from the bank, as far as possible. When the amount in the bank was sufficient to cover this shortfall any balance then remaining in the bank was used as far as possible to provide increases in the pensions-in-pay up to the appropriate level. When the amount in the bank was insufficient to make up this shortfall, the amount which had not been made up was treated as an experience deficiency and, together with interest, became a first charge on future inflationary earnings before pension increases were resumed.

This procedure of applying the inflationary earnings from year Y to the adjustment of pensions in year Y+1 may be summarized in accordance with the following steps:

1.	Amount in the bank at end of year Y (suppose \$2,000)	\$ 2,000
2.	Determine Present value of pensions-in-pay throughout year Y, using non-inflationary rate of interest (suppose \$100,000)	\$100,000
3.	Determine Amount of actual investment return on item 2 in year Y, (suppose at rate 8%)	\$ 8,000
4.	Determine Amount of investment return on item 2 in year Y at non-inflationary rate of return (suppose 3%)	\$ 3,000
5.	Determine Inflationary earnings, by subtracting item 4 from item 3 (\$8,000 - \$3,000)	\$ 5,000
6.	Determine Amount available for increase of pensions-in-pay, by adding the amount in item 5 to the amount in the bank, item 1, (\$5,000 + \$2,000)	\$ 7,000

7. Apply

Amount available (item 6) in accordance with the following priorities:

1st charge - any experience deficiency in item 2 (zero in this example)	0
2nd charge - present value of any shortfall in previous years' pension adjustments (zero in this example)	0
3rd charge - present value of increase in pensions (in item 2) in relation to increase of CPI in year Y (suppose at rate of 4%)	$4,000

8. Determine

The balance remaining from item 6 after applying it in accordance with item 7, i.e. item 6 - item 7 ($7,000 - $4,000)	$3,000

9. This balance of $3,000 is then credited back to the bank for use, together with the investment return on it, in year Y+2 or later as required.

B. <u>Sensitivity Tests</u>

Tables IX-1 and IX-2 of the Task Force report showed the approximate results of indexing to the inflationary earnings of the median pension fund and of three classes of securities. The three tables below show the results obtained from varying the starting date of the inflationary earnings procedure, the demographic characteristics of the pensioner group and the investment performance of the pension fund.

Table 1 was prepared in order to show the approximate extent of the differences in the protection of the real value of the pensions which would have resulted from introducing the procedure of indexing to the inflationary earnings of the median pension fund in the years 1961, 1965 and 1970.

Table 1

The Real Value of a $1.00 Pension Indexed to the Lesser of the Inflationary Earnings of the Median Pension Fund and the Annual Rate of Change in the CPI

	Year of Commencement of Inflationary Earnings Approach and of the Pension		
	1961	1965	1970
	(in constant dollars of the year in which the pension commences)*		
1961	1.00		
1962	1.00		
1963	1.00		
1964	1.00		
1965	1.00	1.00	
1966	1.00	.98	
1967	.97	.94	
1968	.97	.91	
1969	.99	.91	
1970	.94	.87	1.00
1971	.91	.84	.97
1972	.93	.87	1.00
1973	1.00	1.00	1.00
1974	.93	.93	.95
1975	.84	.84	.85
1976	.76	.76	.77
1977	.73	.70	.78
1978	.74	.72	.78
1979	.81	.79	.85

* In year Y when the initial $1.00 pension had increased to $(1+Q), but an increase to $(1+Z) was required for full indexation, then the real value of the pension in Year Y is $\$\frac{(1+Q)}{(1+Z)}$.

The first column of Table 1 shows the combined effect of overall favourable investment returns and low inflation in the years 1961-1965 when a balance was built up in the bank of the plan where the inflationary earnings approach was introduced in 1961. In those years the overall amount of inflationary earnings exceeded the amount needed to finance pension increases at rates equal to the rates of increase in the CPI. This balance at the end of 1965 made it possible to provide higher increases over the years 1966-1972 under the 1961 plan than under the 1965 plan. The latter did not have enough inflationary earnings to provide any pension increases until 1969, having sustained an experience deficiency immediately in 1965 - the year in which it started. Experience from 1973 to 1979 was about the same in these two cases.

Similarly, the plan which introduced this method in 1970 produced better results for those who retired in 1973 than did the two plans where this method was introduced earlier. This result was due to the reserves in the bank which the 1970 plan had accumulated from 1970 to

1973 owing to inflationary earnings in excess of the cost of increasing pensions at rates equal to the rate of increase in the CPI. On the other hand the 1961 and 1965 plans were adversely affected by experience deficiencies incurred in the past on entering this period of higher inflation in 1973.

Thus, while the same pension fund with the same investment experience is used in each of the three plans portrayed in Table 1, the results differ.

Table 2 was prepared to show the results when some demographic characteristics of the pensioner group were altered. Plan A is the mature plan used in developing Table IX-1 of the Task Force report. Plan B is a mature hypothetical plan where the rate of growth in the amount of the pensions-in-pay was approximately half the rate of those in Plan A. Plan C is a relatively new small plan where the first person went on pension in 1961 and the second only in 1969 followed by one to three new pensioners in each of the following years. No pensioners under Plan C died and allowance was made for a gradual increase in the average age of pensioners. Thus the rate of growth in the pensions-in-pay followed quite a different pattern than in either Plan A or Plan B.

Table 2

The Real Value (in Constant 1961 Dollars) of a $1.00 Pension that is Indexed to the Lesser of the Annual Rate of Change in the CPI and the Inflationary Earnings of Different Pension Funds whose Investment Return was Equal to that of the Median Pension Fund

	Plan A	Plan B	Plan C
		(constant $1961)	
1961	1.00	1.00	1.00
1962	1.00	1.00	1.00
1963	1.00	1.00	1.00
1964	1.00	1.00	1.00
1965	1.00	1.00	1.00
1966	1.00	1.00	1.00
1967	.97	.99	1.00
1968	.97	.98	1.00
1969	.99	1.00	1.00
1970	.94	.95	.96
1971	.91	.92	.93
1972	.93	.93	.99
1973	1.00	1.00	1.00
1974	.93	.93	.94
1975	.84	.84	.85
1976	.76	.76	.77
1977	.73	.70	.73
1978	.74	.72	.72
1979	.81	.78	.75

These results indicate that the composition of the pensioner group had little effect on the extent to which the real value of pensions-in-pay were protected.

Table 3 was prepared to show the effects of variations in the investment return of the pension fund of the same plan as was used in developing Table 1 and Column A of Table 2. The first column is the same in each of these three tables. The second and third columns in Table 3 show the results where the investment returns differed annually by one percentage point, plus and minus, from those of the median pension fund in the first column.

Table 3

The Real Value (In Constant 1961 Dollars) of a $1.00 Pension that is Indexed to the Lesser of the Annual Rate of Change in the CPI and the Inflationary Earnings of a Pension Fund With Varying Investment Returns

		Investment Return	
	Median Fund	Median Fund + 1%	Median Fund - 1%
		(constant $1961)	
1961	1.00	1.00	1.00
1962	1.00	1.00	1.00
1963	1.00	1.00	1.00
1964	1.00	1.00	1.00
1965	1.00	1.00	1.00
1966	1.00	1.00	1.00
1967	.97	1.00	.96
1968	.97	1.00	.93
1969	.99	1.00	.92
1970	.94	.96	.88
1971	.91	.93	.85
1972	.93	1.00	.83
1973	1.00	1.00	.98
1974	.93	.96	.91
1975	.84	.87	.82
1976	.76	.78	.74
1977	.73	.81	.69
1978	.74	.82	.64
1979	.81	.88	.73

The results shown in the foregoing tables suggest that the degree to which the real value of pensions will be maintained under an inflationary earnings approach will be significantly affected by the investment returns earned by the pension fund in question and little affected by the alterations which were made in the demographic characteristics of the particular group. As well, the variation over time of investment returns and of the rate of inflation means that the time of introduction of an inflationary earnings scheme will affect the extent to which pension values are maintained.

ANNEX TO APPENDIX 20

DETAILED METHODOLOGY OF INFLATIONARY EARNINGS APPROACH TO INDEXING PENSIONS

In order to calculate the indexing costs and account balances, the following data first had to be provided, for the years 1961 through 1978.

A. The annuities-in-pay each year. These were estimated to be 12 x monthly rate in the preceding December, and include initially only the basic pensions. As the algorithm proceeds the increases due to indexation are added.

B. The amounts subject to indexation each year. These were estimated to be 12 x monthly rate in July from the previous year's annuities-in-pay by assuming that deaths of pensioners included in A occur at mid-year and that new pensioners who have just retired receive on average only half the full increase. All deferred annuitants and survivors of deceased annuitants receive the full increase as soon as their benefits come into pay. This was also assumed to occur at mid-year. The algorithm adds the indexation increases to these members also.

P. The annual average rate of increase in the Consumer Price Index in the previous year.

R. The annual nominal rate of return of the particular type of investment under consideration.

ANNUITY_COST An annual series of constants which reflects the (approximate) cost of a $1 annuity at the fixed rate of interest CONSTANT_2. This series was changed from year to year if the average age of the population changed significantly.

CONSTANT_1 The rate of survival of the pensioners each year.

CONSTANT_2 The non-inflationary rate of return assumed for the calculation of annuity costs. Indexation of benefits is provided by the actual return in excess of (CONSTANT_2)% on the accumulated pension funds, each year.

These were all the inputs to the computation.

The first computation was to find the 'inflationary earnings' which could be applied for purposes of indexation for the years 1961-1978. The current year, or 'this year', is denoted by the letter 'y'.

F. The rate of inflationary earnings which could be used for indexation purposes was taken to be the rate of return minus CONSTANT_2. F(y) = R(y) - CONSTANT_2

Ten new time series, which are referred to by D, E, G, H, I, K, L, M, N, and O were created for years 1961-1978. Their definitions are given below.

D. The maximum possible total increase in pensions due to last year's inflation is defined to be (last year's CPI rate of increase) times (this year's amount subject to indexation), or D(y) = P(y) x B(y), where P(y) is the CPI rate of increase used in this year, and B(y) is the amount subject to indexation this year.

E. The annuity cost of the total pensions-in-pay; which is the ANNUITY_COST constant times the total pensions-in-pay. This estimates the size of the fund required to provide these pensions. E(y) = ANNUITY_COST(y) x A(y)

G. The accumulated balance of inflationary earnings that the fund has available for indexation at the beginning of each year from the amounts remaining at the end of the preceding year. G(y) = O(y-1)

H. The amount required to pay the outstanding percentage of previous years' indexation not received to date by the surviving pensioners. These additional benefits were not paid due to shortfalls in previous years. Only a reduced fraction of last year's obligations may need to be paid because of mortality. H(y) = M(y-1) x CONSTANT_1

I. The amount required for new indexation each year is the product of the ANNUITY_COST constant times the maximum possible total increase in pensions due to last year's inflation. I(y) = D(y) x ANNUITY_COST(y)

K. The amount needed to pay all the past shortfalls plus new costs of indexation. K(y) = H(y) + I(y)

L. The value of the contribution to indexed annuities which can be made this year. The lesser of the amounts G and K for this year. If G is not positive, then L is set equal to zero. If G is less than K, H is paid in full before any portion of I is paid. L(y) = inf (G(y), K(y))

M. The amount (if any) by which the funds available fall short of the full costs of indexation. M(y) = K(y) - L(y)

N. The amount of new money that is available at the end of each year for the future indexation of benefits is the inflationary earnings rate times the estimated fund, E, for this year. N(y) = F(y) x E(y)

O. The outstanding balance of funds available for future indexation which is left over from the current and previous years. This is measured at year end, and the portion of this balance not required for indexation in the following year accrues interest. O(y) = N(y) + (G(y) - L(y)) x (1 + R(y))

Benefits are indexed on January 1 each year, provided that funds are available (in Column G) from last year's accumulated balances (Column O). The amount K(y) needed to pay off all previous funding shortfalls H(y) plus this year's new costs I(y) is found. If G(y) is positive, then the lesser of G(y) and K(y) is paid towards purchasing additional (indexed) benefits for those eligible pensioners whose benefits are reflected in B(y). The amount paid is L(y). L(y) is set equal to zero if G(y) is not positive, and no indexation occurs this year. If in any year $L(y) > 0$, the pensions then in pay are increased by the amounts which L(y) will purchase and these amounts will continue to be paid to the pensioners who receive them for that year and all subsequent years. The assumption is made that the mortality rate of pensioners is a constant equal to CONSTANT_1.* Columns A and B are adjusted as follows for these new increments to the pensions:

let c = CONSTANT_1, p = L(y) / ANNUITY_COST (y);

if there is a sufficient accumulated balance to provide $p additional pension because of indexation this year (purchased at the same annuity costs used for the other pensions), then by the constant decrement assumption there will only be

$pc paid the next year to the survivors
$pcc paid the following year, etc; then

set **

$$
\begin{aligned}
A(y) &:= A(y) + p & B(y) &:= B(y) + p \\
A(y+1) &:= A(y+1) + pc & B(y+1) &:= B(y+1) + pc \\
A(y+2) &:= A(y+2) + pcc & B(y+2) &:= B(y+2) + pcc \\
A(1978) &:= A(1978) + pc^{(1978-y)} & B(1978) &:= B(1978) + pc^{(1978-y)}.
\end{aligned}
$$

This process of adjusting the values of A and B is referred to in the algorithm below as a subroutine called ADJUST, which is utilized during each year that indexing adjustments are made.

If a full adjustment cannot be made this year, the shortfall M(y) is computed.

In the preparations for the next year, the assumed fund size E(y), the amount of money available for future indexation N(y), and the year-end accumulated balance O(y) are computed.

These are presented as an algorithm below, beginning in year 1961, where no indexation of benefits is assumed to occur, and ending at the end of 1978.

---

* CONSTANT_1 was derived by averaging the known rates for a large plan except in Plan C in Table 2 where it was set equal to 1 to simulate no deaths in the plan. The results do not seem very sensitive to small changes in this value.

** The symbol ':=' should be thought of as meaning 'is replaced by'.

Algorithm

```
(1) Y:= 1961 // Y MEANS YEAR

(2) B(1961):=0 // THIS CAUSES THE FUND TO BE BUILT UP

(3) M(1960):=0

(4) O(1960):=0

(5) DO WHILE Y < 1979  // BEGIN LOOP

(6)         F(Y):= R(Y) - CONST_2

(7)         D(Y):= B(Y) x P(Y)

(8)         I(Y):= D(Y) x ANNUITY_COST(Y)

(9)         H(Y):= M(Y-1) x CONST_1

(10)        K(Y):= I(Y) + H(Y)

(11)        G(Y):= O(Y-1)

(12)        IF  G(Y) > 0

(13)            THEN L(Y):= INF (K(Y), G(Y))

(14)            OTHERWISE L(Y):= 0

(15)        CALL ADJUST // INDEXATION ADJUSTMENT FOR PENSIONS

(16)        M(Y):= K(Y) - L(Y)

(17)        E(Y):= A(Y) x ANNUITY_COST(Y)

(18)        N(Y):= E(Y) x F(Y)

(19)        O(Y):= N(Y) + ((O(Y-1) - L(Y)) x (1 + R(Y))

(20)   Y: = Y +1

(21) RETURN
```

Table 4 provides an example of the results of these calculations using the inflationary earning of the median pension fund with a non-inflationary rate of investment return of 4%. The data in this table were used to compute the first columns of Tables 1, 2 and 3.

TABLE 4

YEAR	A	B	P	D	E	R	F	N	I	G	H	K	L	M	O
1961	40.0	0.0	1.3067	0.0000	468.0000	13.380	9.380	43.898	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	43.8984
1962	43.6	37.3	0.8748	0.3263	510.1200	1.160	-2.840	-14.487	3.8179	43.8984	0.0000	3.8179	3.8179	0.0000	26.0581
1963	48.1	43.5	1.2008	0.5224	562.7724	8.220	4.220	23.749	6.1115	26.0581	0.0000	6.1115	6.1115	0.0000	45.3352
1964	53.4	48.2	1.7469	0.8412	624.2740	11.500	7.500	46.821	9.8425	45.3352	0.0000	9.8425	9.8425	0.0000	86.3949
1965	59.2	53.1	1.7925	0.9513	692.2907	3.700	-0.300	-2.077	11.1298	86.3949	0.0000	11.1298	11.1298	0.0000	75.9731
1966	65.0	58.0	2.4610	1.4281	760.8241	-2.500	-6.500	-49.454	16.7084	75.9731	0.0000	16.7084	16.7084	0.0000	8.3295
1967	71.6	64.7	3.7374	2.4168	837.2907	6.900	2.900	24.281	28.2761	8.3295	0.0000	28.2761	8.3295	19.9466	24.2814
1968	78.4	72.0	3.5729	2.5742	917.8558	9.300	5.300	48.646	30.1183	24.2814	18.3508	48.4691	24.2814	24.1877	48.6464
1969	88.7	83.9	4.0856	3.4261	1037.3054	-1.600	-5.600	-58.089	40.0853	48.6464	22.2527	62.3380	48.6464	13.6917	-58.0891
1970	103.6	96.8	4.5084	4.3621	1211.5944	3.200	-0.800	-9.693	51.0369	-58.0891	12.5963	63.6333	0.0000	63.6333	-69.6407
1971	114.3	105.4	3.3661	3.5464	1336.7797	12.800	8.800	117.637	41.4923	-69.6407	58.5426	100.0349	0.0000	100.0349	39.0819
1972	129.0	107.0	2.8366	3.0354	1509.4205	17.400	13.400	202.262	35.5145	39.0819	92.0321	127.5466	39.0819	88.4648	202.2623
1973	149.3	120.6	4.7750	5.7582	1746.6998	-2.100	-6.100	-106.549	67.3709	202.2623	81.3876	148.7585	148.7585	0.0000	-54.1684
1974	182.4	157.5	7.6115	11.9879	2134.0401	-10.500	-14.500	-309.436	140.2588	-54.1684	0.0000	140.2588	0.0000	140.2588	-357.9166
1975	206.6	189.8	10.8647	20.6249	2417.6045	13.200	9.200	222.420	241.3108	-357.9166	129.0381	370.3489	0.0000	370.3489	-182.7419
1976	235.6	222.8	10.8133	24.0923	2756.5461	13.100	9.100	250.846	281.8805	-182.7419	340.7210	622.6014	0.0000	622.6014	44.1646
1977	271.1	251.8	7.5081	18.9050	3171.8004	8.900	4.900	155.418	221.1885	44.1646	572.7933	793.9819	44.1646	749.8173	155.4182
1978	318.4	295.9	7.9910	23.6432	3724.9442	13.400	9.400	350.145	276.6256	155.4182	689.8319	966.4575	155.4182	811.0393	350.1448